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THE DEVELOPMENT AND VALIDATION  
OF A NOVEL ANXIETY SCALE TO  
MEASURE AND SCREEN ANXIETY IN  
PATIENTS WITH COPD

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A thesis submitted in partial fulfilment  
of the requirements of the Manchester  
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of Doctor of Philosophy

Department of Health Professions  
Faculty of Health, Psychology and Social  
Care

The Manchester Metropolitan  
University

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## ABSTRACT

There is a high prevalence of co-morbid anxiety disorders in patients with chronic obstructive pulmonary disease (COPD). Although co-morbid anxiety impacts negatively upon health-related quality of life, physical functioning and healthcare utilisation, anxiety disorders remain significantly under recognised and undermanaged. One reason for this may be the lack of a validated disease-specific patient-reported screening tool and outcome measure. Existing scales may be limited by their inclusion of somatic items, which may overlap with symptoms of COPD or the side-effects of medications.

This thesis aimed to develop a novel non-somatic self-report anxiety scale that can be used to screen for anxiety disorders and assess the severity of anxiety in patients with COPD. The Anxiety Inventory for Respiratory disease (AIR) was developed using a mixed methods approach to item development that incorporated both emic (interviews with 14 COPD patients) and etic (review of extant anxiety scales) perspectives to generate 16 novel items scored using a Likert-type response set. Patients and clinicians were involved in the development of the AIR to ensure that the scale is user-friendly and clinically relevant. Qualitative findings from the interviews also provide a unique insight into the experience of anxiety from the patients' perspective and support the non-somatic format of the AIR.

The draft 16-item AIR was completed by 88 patients with COPD and refined through rigorous item and factor analysis. Six items were removed to create the final 10-item AIR (score range 0-30). The reliability and validity of the AIR were examined in a sample of 56 COPD outpatients. The AIR proved to have excellent internal consistency in all phases (Cronbach's  $\alpha = 0.92-0.95$ ) and test-retest reliability (Intraclass correlation coefficient = 0.81). The AIR also demonstrated high convergent validity with the Hospital Anxiety and Depression Scale (Spearman's rho correlation = 0.91) and was able to discriminate between patients with and without anxiety disorders ( $p < 0.001$ ). Confirmatory factor analysis found that a two-factor model containing two intercorrelated factors (general anxiety and panic) provided the best fit. The AIR was able to accurately screen for anxiety disorders. The area under the curve (AUC) for the AIR based on the Patient Health Questionnaire anxiety screener was 0.96. A cut-off score of 15 produced a sensitivity of 0.93 and a specificity of 0.98.

Although further research is required to validate the AIR in larger clinical populations, the findings presented in this thesis support the use of the scale as a reliable and valid marker of anxiety in patients with COPD. The AIR is also a promising screening tool for anxiety disorders, particularly panic disorder and generalised anxiety disorder in patients with COPD.

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## OUTPUTS AND DISSEMINATION

### Journal articles

Willgoss, T.G., Yohannes, A.M., Goldbart, J., Fatoye, F. (2012) 'Everything was spiralling out of control': Experiences of anxiety in people with chronic obstructive pulmonary disease. *Heart & Lung*, Vol. 41, no. 6, pp. 562-571.

Willgoss, T.G., Yohannes, A.M. (2012) Anxiety disorders in patients with chronic obstructive pulmonary disease: a systematic review. *Respiratory Care*, Vol. 58, no. 5, pp. 858-866.

Willgoss, T.G., Yohannes, A.M., Goldbart, J., Fatoye, F. (2011) The development of a novel scale to screen and measure anxiety in patients with chronic obstructive pulmonary disease (COPD). *Thorax*, Vol. 66, Suppl. 4, pp. A44.

Willgoss, T.G., Yohannes, A.M., Goldbart, J., Fatoye, F. (2011) COPD and anxiety: its impact on patients' lives. *Nursing Times*, Vol. 107, no. 15-16, pp. 16-19.

Yohannes, A.M., Willgoss, T.G., Baldwin, R.C., Connolly, M.J. (2010) Depression and anxiety in chronic heart failure and chronic obstructive pulmonary disease: prevalence, relevance, clinical implications and management principles. *International Journal of Geriatric Psychiatry*, Vol. 25, no. 12, pp. 1209-1221.

### Conference presentations

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“Everything was spiralling out of control” Accounts of anxiety in COPD. Willgoss T, Yohannes AM, Goldbart J, Fatoye F. Chartered Society of Physiotherapists Annual Conference, Liverpool 2011. (Platform presentation).

“When am I going to get my next breath?” A qualitative study of the experience of anxiety in people with COPD.’ Willgoss T, Yohannes AM, Goldbart J, Fatoye F. IV World Asthma and COPD Forum, Paris 2011. (Poster presentation).

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## ABBREVIATIONS

ACCP: American College of Chest Physicians

ADL: Activities of daily living

ADIS-IV: Anxiety Disorders Interview Schedule for DSM-IV

AECOPD: Acute exacerbation of chronic obstructive pulmonary disease

AGECAT: Automatic Geriatric Examination for Computer Assisted Taxonomy

AIR: Anxiety Inventory for Respiratory disease

APA: American Psychiatric Association

ARAS: Acute Respiratory Assessment Service

ATS: American Thoracic Society

AUC: Area under the curve

BAI: Beck Anxiety Inventory

BIC: Bayesian information criterion

CAT: COPD Assessment Tool

CBT: Cognitive behavioural therapy

CFA: Confirmatory factor analysis

CFI: Comparative fit index

CI: Confidence interval

CIDI: Composite International Diagnostic Interview

COPD: Chronic obstructive pulmonary disease

CSAQ: Cognitive-Somatic Anxiety Questionnaire

CTT: Classical test theory

DALY: Disability adjusted life year

DASS: Depression Anxiety Stress Scale

DSM-IV-TR: Diagnostic and Statistical Manual for Mental Disorders-Fourth Edition-Text Revision

EFA: Exploratory factor analysis

ERG: Expert reference group

ERS: European Respiratory Society

ESAS: Edmonton Symptom Assessment System

FA: Factor analysis

FDA: American Food and Drug Administration

F-DIPS: Diagnostisches Interview für Psychische Störungen-Forschungsversion

FEV<sub>1</sub>: Forced expiratory volume in one second

FVC: Forced vital capacity

GAD: Generalised anxiety disorder

GAD-7: Generalized anxiety disorder-7

GADS: Goldberg Anxiety and Depression Scale

GAI: Geriatric Anxiety Inventory

GFI: Goodness-of-fit index

GMS: Geriatric Mental State Schedule

GOLD: Global Initiative for Chronic Lung Disease

HADS: Hospital Anxiety and Depression Scale

HADS-A: Hospital Anxiety and Depression Scale-Anxiety

HADS-D: Hospital Anxiety and Depression Scale-Depression

HADS-T: Hospital Anxiety and Depression Scale-Total

HR: Hazard ratio

HRQoL: Health related quality of life

ICC: Intraclass correlation coefficient

ICD-10: International Classification of Diseases-10

IRR: Incidence rate ratio

IRT: Item response theory

KMO: Kaiser-Meyer-Olkin

MDD: Major depressive disorder

MHI-38: Mental Health Inventory-38

MINI: Mini-International Neuropsychiatric Interview

MOMAI: Mind Over Mood Anxiety Inventory

MRADL: Manchester Respiratory Activities of Daily Living questionnaire

NCCCC: National Collaborating Centre for Chronic Conditions

NFI: Normed fit index

NHS: National Health Service

NNFI: Non-normed fit index

NICE: National Institute of Clinical Excellence

NPV: Negative predictive value

NRES: National Research Ethics Service

OCD: Obsessive-compulsive disorder

PA: Panic attack

pCO<sub>2</sub>: Partial pressure of carbon dioxide

PD: Panic disorder

PDSS-SR: Panic Disorder Severity Scale-Self Report

PPV: Positive predictive value

PR: Pulmonary rehabilitation

PRIME-MD: Primary Care Evaluation of Mental Disorders

PROMs: Patient reported outcome measures

PSWQ: Penn State Worry Questionnaire

PTSD: Post-traumatic stress disorder

RMSEA: Root mean square error of approximation

ROC: Receiver operating characteristics

SAS: Self-rating Anxiety Scale

SAST: Short Anxiety Screening Test

SCID: Structured Clinical Interview for DSM

SCL-90: Symptom Checklist-90

SD: Standard deviation

SDS: Zung Self-rating Depression Scale

SEM: Structural equation modelling

SF-36: Short Form (36) Health Survey

SGRQ: St George's Respiratory Questionnaire

SMD: Standard mean difference

SPSS: Statistical Package for Social Sciences

SRMSR: Standardised root mean square residual

SSRIs: Selective serotonin reuptake inhibitors

STAI: State-Trait Anxiety Inventory

TB: Tuberculosis

TLI: Tucker-Lewis index

TMAS: Taylor Manifest Anxiety Scale

TZAs: Tricyclic antidepressants

UK: United Kingdom

USA: United States of America

# Chapter 1 : INTRODUCTION TO STUDY

*"A crust eaten in peace is better than a banquet partaken in anxiety."*

Aesop

## 1.1 BACKGROUND TO THE STUDY

Chronic obstructive pulmonary disease (COPD) is a preventable, progressive condition that is characterised by a decline in lung function. The National Institute of Clinical Excellence (NICE, 2010: 5) defines COPD as:

*"... characterised by airflow obstruction. The airflow obstruction is usually progressive, not fully reversible and does not change markedly over several months."*

Chronic airflow obstruction in COPD is caused by both obstruction and destruction of alveoli and the small airways. This results in a mixture of chronic bronchitis and emphysema, the relative contributions of which vary between individuals (Rabe, 2007). Alongside the changes in lung function, patients with COPD exhibit a number of common symptoms including exertional breathlessness, chronic cough, regular sputum production, and a chronic wheeze (Global Initiative for Chronic Lung Disease; GOLD, 2011).

The classification and diagnosis of COPD is usually undertaken with spirometry, which provides a simple descriptor of pathological changes. Post-bronchodilator measures of forced expiratory volume in one second (FEV<sub>1</sub>) and forced vital capacity (FVC) enable the classification of COPD into categories e.g., mild, moderate, severe and very severe (see Table 1.1). Despite slight variations in wording, the British, American and European respiratory bodies define mild COPD as the ratio of FEV<sub>1</sub> to FVC being < 0.7 and the FEV<sub>1</sub> being ≥80% of the predicted value (Celli & MacNee, 2004; GOLD, 2011; NICE, 2010).

Table 1.1: Classification of COPD according to ATS/ERS, GOLD and NICE guidelines

Post bronchodilator FEV <sub>1</sub> /FVC	FEV <sub>1</sub> % Predicted	ATS/ERS (Celli & MacNee, 2004)	GOLD (2011)	NICE (2010)
		Severity of airflow obstruction		
<0.7	≥80%	Mild	Grade 1- Mild	Grade 1- Mild
<0.7	50-79%	Moderate	Grade 2- Moderate	Grade 2- Moderate
<0.7	30-49%	Severe	Grade 3- Severe	Grade 3- Severe
<0.7	<30%	Very severe	Grade 4- Very severe	Grade 4- Very severe

ATS, American Thoracic Society; ERS, European Respiratory Society; GOLD, Global Initiative for Chronic Lung Disease; NICE, National Institute for Clinical Excellence; FEV<sub>1</sub>, Forced expiratory volume in one second; FVC, Forced vital capacity

It is generally assumed that there is a significant under-diagnosis of COPD worldwide and, as a result, many individuals live with undetected lung disease. One reason for this is that the disease is not usually recognised until it is clinically apparent and moderately advanced (Pauwels & Rabe, 2004). In England and Wales some 900,000 people have diagnosed COPD, but it is

estimated that the true figure might be 1.5-3 million, allowing for under-diagnosis (Devereux, 2006; Healthcare Commission, 2006). It is estimated that 24 million Americans may have impaired lung function, whilst less than half of this number (10 million) report a physician diagnosis of COPD (Mannino et al., 2002).

The prevalence of COPD varies between 2% and 10% globally (Pauwels & Rabe, 2004). A large population-based study from Spain found that COPD was present in 9.1% of a sample of over 4000 men and women aged 40-69 years. Of those identified with COPD, 78% had not been previously diagnosed and only 49% of patients with severe COPD, 12% of patients with moderate COPD, and 10% of patients with mild COPD were receiving treatment (Peña et al., 2000). The prevalence of COPD also appears to increase with age. A study from the USA found that the prevalence of moderate COPD increased from 7.2% in people aged 45-54 years to 22.9% in those aged 75 years and older (Mannino et al., 2002).

Traditionally, COPD has been more common in men than in women. Data from Spain suggest that the prevalence of COPD was 14.3% in men compared to 3.9% in women (Peña et al., 2000). Despite this, the prevalence of COPD in women has been gradually increasing during the past few decades (0.8% in 1990) and is continuing to rise. In contrast, the incidence of COPD in men is thought to have plateaued (Devereux, 2006). The World Health Organisation (WHO) have proposed that increased tobacco use by women in high-income countries, alongside the increased exposure to indoor air pollution (such as fuel for



cooking and heating) in low-income countries, has resulted in COPD affecting men and women almost equally (WHO, 2011). Data from the USA demonstrated that in 2000, the number of women dying from COPD surpassed the number of men dying for the first time (Mannino et al., 2002). Recent evidence indicates that COPD may now be more common in women than in men (National Health Interview Survey, 2007).

COPD is a major cause of mortality worldwide. The 2002 World Health Report identifies COPD as the fifth leading cause of death in the world, killing over 2.6 million people in 2001 (WHO, 2002). This figure is predicted to rise with some experts forecasting that COPD will be the third leading cause of death worldwide by 2020 (Murray & Lopez, 1997). In the USA, the number of women who died from COPD increased by 182% between 1980 and 2000 whilst in men this figure rose by just 13% (Mannino et al., 2002).

The increase of mortality in COPD contrasts with that of other chronic diseases including cardiovascular diseases and stroke. For example, in the USA the death rate of COPD increased by 102.8% between 1970 and 2002, whilst coronary heart disease and stroke reduced by 52.1% and 63.1% respectively (Jemal et al., 2005). In the UK, 27,700 people died of COPD in 2004, a figure higher than that of all types of cancer (except respiratory cancers), and third only to ischaemic heart disease and cerebrovascular disease (WHO, 2009).

There is a significant morbidity associated with COPD. In particular, COPD has a major burden in terms of disability and ill health. The burden of COPD on the

population is often measured in terms of a disability-adjusted life year (DALY). This represents the number of years lost due to ill health, levels of disability and early death. Worldwide, COPD is expected to rise from the 12<sup>th</sup> leading cause of DALYs in 1990 to become the fifth leading cause of DALYs by 2020 (Lopez & Murray, 1998). Additionally, although only a small proportion of patients with COPD are admitted to hospital each year, one in every eight emergency hospital admissions in the UK is for COPD. This makes COPD the second largest cause of emergency hospital admissions and one of the most costly conditions treated by the National Health Service (NHS) in the UK (British Lung Foundation, 2007).

COPD seldom occurs in isolation and often co-exists with other chronic diseases (Fabbri et al., 2008). Co-morbidities in COPD may be due to systemic inflammation, shared risk factors, or the sequelae of COPD e.g., reduced physical activity (Fabbri et al., 2008; GOLD, 2011). Perhaps unsurprisingly for a chronic smoking-related disease, COPD commonly co-occurs with a number of other diseases that share tobacco smoke as a risk factor. There is growing evidence that the systemic inflammation caused by cigarette smoking may also cause some of the most common co-morbidities in patients with COPD, including cardiovascular, liver, pancreatic, muscle and bone disease (Fabbri et al., 2008). Data from the recent National COPD Audit indicate that 77% of inpatients admitted for COPD had one or more medical conditions in addition to their COPD (Royal College of Physicians, British Thoracic Society & British Lung Foundation, 2008).

Psychiatric disorders are amongst the most common and disabling co-morbidities among patients with COPD. Recent data suggest that almost half of all patients with COPD (49%) might have a co-morbid psychiatric disorder (Laurin et al., 2007). The most common psychiatric co-morbidities are mood disorders (including depression) and anxiety (including panic), which affect about 17% and 46% of patients respectively. In addition, a quarter of patients with COPD may have two or more psychiatric disorders, with 14% having both a mood and anxiety disorder (Laurin et al., 2007).

Anxiety may be defined as an apprehensive anticipation of danger or stressful situations associated with excessive feelings of dysphoria or somatic symptoms of tension. Symptoms of anxiety include feelings of restlessness, difficulty concentrating, muscle tension, fatigue, irritability and sleep disturbance. Panic is characterised by a sudden onset of physical symptoms including breathlessness, chest pains and trembling sensations, alongside psychological symptoms that include intense fear, fear of dying and detachment (American Psychiatric Association, APA, 2000; Spielberger et al., 1983).

Although anxiety and depression frequently co-occur and overlap in their symptomology, they may be considered as specific psychiatric conditions, particularly under a nosological medical classification system such as DSM-IV-TR (APA, 2000). Anxiety can generally be distinguished from depressive states as it is characterised by vasomotor responsiveness, as well as panic attacks, derealisation and perceptual dysfunctions. Depression, however, is characterised by a general negative affect associated with a loss of interest and

pleasure, hopelessness, emotional withdrawal and excessive fatigue (Gelenberg, 2000). A major difference between anxiety and depression is that the emotional pattern of anxiety is future oriented and predictive of threat, whilst depressive responses are tied to imminent or past events which have a direct bearing on self-esteem (Dobson, 1985).

Two of the most prevalent and recognisable anxiety disorders in patients with COPD are generalised anxiety disorder (GAD) and panic disorder (PD) with or without agoraphobia, which affect up to 33% and 41% of patients respectively (Dowson et al., 2004). In contrast, the prevalence of GAD among community-based older adults is between 1-7%, whilst the prevalence of PD (with or without agoraphobia) is between 0.1 and 2% (Kirmizioglu et al., 2009; Wolitzky-Taylor et al., 2010). Estimates of anxiety prevalence based on threshold scores on self-report anxiety scales suggest that clinically significant symptoms of anxiety may be present in up to 74% of patients with COPD (Yohannes et al., 2010).

Despite the high prevalence of anxiety disorders in patients with COPD, there has been surprisingly little focus upon anxiety within the literature. This is also the case among the general elderly population, where anxiety remains less well studied than other psychiatric disorders such as depression (Pachana et al., 2007). Findings from a recent study by Kunik and colleagues (2005) indicate that anxiety is less recognised than depression in patients with COPD. Kunik et al. (2005) found that 43% of patients with a depressive disorder had been

previously diagnosed, compared to only 29% of patients with an anxiety disorder.

There is growing evidence to suggest that co-morbid anxiety in patients with COPD impacts negatively on a number of key measurable outcomes including functional status, health related quality of life (HRQoL) and healthcare utilization (e.g., Felker et al., 2010; Gudmundsson, 2006; Kim et al., 2000).

Anxiety may also be a major predictive factor for increased hospital admissions for acute exacerbation of COPD (AECOPD) in the elderly (Yohannes et al., 2000a). Anxiety also has a significant emotional impact in patients with COPD. Qualitative accounts from patients with COPD indicate that co-morbid anxiety is associated with intense fear, inextricable breathlessness and near-death experiences (Bailey, 2001; Bailey 2004; Barnett, 2005). However, remarkably little is known about how patients with COPD experience anxiety, particularly which symptoms are most common and how these interact with respiratory disease.

The “gold standard” diagnosis of anxiety is through psychiatric interview with a qualified practitioner, yet this is often impractical due to the time-consuming nature of the interview. Therefore, routine screening for anxiety is typically undertaken using specifically designed scales, which can identify patients who may have clinically significant symptoms of anxiety requiring further investigation. Current clinical guidelines for COPD, such as those from the American College of Chest Physicians (ACCP; Maurer et al., 2008) and Global Initiative for chronic Obstructive Lung Disease (GOLD, 2011) advocate routine

screening for anxiety. Yet, although there are a number of anxiety screening scales in existence, co-morbid anxiety remains poorly recognised and undermanaged (GOLD, 2011; Kunik et al., 2005; NCCCC, 2010; Roundy et al., 2005). For example, Kunik and colleagues found that among 204 patients with COPD and clinically significant anxiety or depression, only 31% were receiving treatment. Furthermore, only 46% of patients with severe anxiety or depression were receiving treatment (Kunik et al., 2005). In another chart review of 102 patients with COPD, only 47% of patients with a clinical anxiety disorder were identified and followed by primary care providers or mental health providers (Roundy et al., 2005).

Researchers and clinicians who recognise the need to identify patients with clinically significant anxiety and/or to measure anxiety levels to monitor interventions, have called for a reliable and easily administered screening and measurement tool (Cheung et al., 2012, Kunik et al., 2005). However, as Jain and Lolak asserted in 2009, the most appropriate “gold standard” anxiety screening instrument for patients with COPD was yet to be identified. The majority of anxiety screening instruments that are used in clinical practice and within research settings have been developed in and for young healthy populations. Few scales have been specifically developed for use in elderly populations and none have been developed specially for patients with COPD where there is a lack of standardisation of appropriate markers (Gudmundsson et al., 2005). Clinical guidelines recommend scales such as the Hospital Anxiety and Depression Scale-Anxiety (HADS-A; Zigmond & Snaith, 1983), Beck Anxiety Inventory (BAI; Beck et al., 1988) and Depression Anxiety Stress Scales (DASS;

Lovibond & Lovibond, 1995) for measuring and screening anxiety in patients with COPD. However, these scales, although popular within COPD-related research and clinical practice, have a number of documented shortcomings that may make them unsuitable for use in patients with chronic somatic disease, particularly COPD.

Perhaps the most important and widely recognised limitation of these scales is their inclusion of somatic items. The NCCC (2011), among others (e.g., Jain & Lolak, 2009), recognise that there is a significant potential overlap between symptoms of COPD and the somatic symptoms of anxiety (e.g., breathlessness, heart palpitations). However, recommended extant scales include a number of somatic items. For example, the BAI contains a total of 21 items, of which 14 reflect the somatic symptoms of anxiety. Although somatic symptoms are a key component in the diagnosis of anxiety, their inclusion in anxiety scales leads to the possibility of false positives when used for screening purposes in patients with somatic disease. Findings from Ferguson et al. (2006) provide some support for the utility of somatic items of the BAI for measuring anxiety in patients with COPD, yet many experts still question the validity of somatic items for measuring and screening anxiety in this patient group (Jain & Lolak, 2009; Mikkelsen et al., 2004; NCCC, 2011).

There are also questions relating to the content of extant scales, particularly regarding their symptom coverage. This is likely to be a result of the theoretical considerations that underpin each scale. The DASS, for example, is designed to distinguish between symptoms of anxiety and depression and therefore focuses

on symptoms that are unique to each disorder. Items measuring symptoms such as tension and irritability are omitted as they relate to both anxiety and depression (McDowell, 2006). Whilst this strengthens the scale in terms of its power to discriminate between psychiatric conditions, its use as a general screening and measuring tool for anxiety is limited as common symptoms of anxiety are not included (McDowell, 2006).

Often, 'off-the-shelf' tools may be inappropriate or suboptimal (DeVellis, 2003; Redding et al., 2006). Few extant anxiety scales have been validated (in a limited fashion) in COPD populations and their recommended use in patients with COPD is based primarily upon psychometric data from healthy populations or patients with other diseases. The high prevalence and under recognition of co-morbid anxiety in patients with COPD indicates (alongside the other barriers to recognition) that a reliable and valid screening tool and anxiety marker is needed. This would have clinical utility by acting as a screening tool and anxiety marker in clinical practice, but also as an outcome measure for research.

The aim of this research, therefore, was to develop a novel scale to act as a marker and screener for anxiety in patients with COPD. The scale addresses some of the documented limitations of existing scales by containing only somatic items and by being developed specifically for patients with COPD. According to Kunik et al. (2007) the goal of an effective screening instrument is to maximise recognition of patients with clinically significant symptoms. Therefore, a screening tool for anxiety in patients with COPD should have a high sensitivity (Jain & Lolak, 2009). To achieve this goal, it is important that the



scale contains items that are relevant to the patient, yet also recognises those whose symptoms reach a level where management is required. Therefore, this research sought to include patients in the development of a scale, both in terms of eliciting patients' experiences to identify appropriate anxiety symptoms (to ensure item coverage) and in the design of the scale (to ensure user-friendliness). This approach is advocated by guidelines that guide the development of patient reported outcome measures (PROMs; American Food and Drug Administration; FDA, 2009)

## 1.2 AIM OF THE STUDY

The aim of the study was to develop a non-somatic anxiety scale that can be used as a marker of anxiety in patients with COPD and also screen for GAD and PD.

## 1.3 RESEARCH OBJECTIVES

Three research objectives were developed to guide this study:

1. To explore the experience of anxiety in patients with COPD and to develop potential scale items based on both patients' experiences of anxiety and the content of extant anxiety scales.
2. To develop a novel and user-friendly non-somatic scale that can be used as a screening tool and as a marker of anxiety in patients with COPD.

3. To establish the reliability, validity and clinical utility of the novel scale in a clinical population of patients with COPD.

## 1.4 OUTLINE OF THESIS

Chapter 1 has discussed the background to the study and has outlined the aims of the research.

Chapter 2 provides a detailed overview of anxiety in patients with COPD. The chapter begins by providing an introduction to the psychological and medical models of anxiety. It then proceeds to review the prevalence of clinically relevant symptoms of anxiety and anxiety disorders in patients with COPD, and summarises the aetiology, risk factors, impact and management of co-morbid anxiety in patients with COPD. Finally, the chapter critically reviews issues relating to anxiety markers and screening, with a specific focus on the strengths and limitations of existing self-report anxiety scales.

Chapter 3 critically discusses self-report ratings scales and the key considerations in scale development, particularly issues surrounding reliability and validity. A comprehensive review of the scale development process is also provided and consideration is given to the theory that drives the scale development process of the current research.

Chapter 4 presents the research methodology. The chapter discusses the conceptual framework of the research and outlines the research design. Ethical considerations are also discussed within this chapter.

Chapter 5 describes Phase 1 of the research; an item development process that incorporated both emic and etic perspectives to develop a pool of novel items for the anxiety scale.

Chapter 6 describes Phases 2 and 3 of the research. In Phase 2 of the research the original pool of items was condensed using statistical techniques to create the final scale. In Phase 3, the reliability, validity and clinical utility of the new scale were examined in a clinical sample of patients with COPD.

Chapter 7 discusses the findings from the three phases of research and considers the strengths and limitations of the research.

Chapter 8 contains the summary, clinical and theoretical implications, recommendations for future research and conclusion.

## 1.5 SUMMARY OF CHAPTER 1

It is clear from the outset that COPD is a common condition with a growing global prevalence. Anxiety disorders are amongst the most common co-morbidities in patients with COPD and have a significant deleterious impact on HRQoL and healthcare utilisation if untreated. However, anxiety disorders are

both under detected and undermanaged in patients with COPD. Although existing anxiety scales have been recommended to detect and monitor anxiety in this patient group, there are a number of documented limitations, particularly their inclusion of somatic items. Therefore, the primary aim of the current research is to develop a novel disease-specific non-somatic anxiety scale to screen and act as a marker of anxiety in patients with COPD.

The following chapter explores co-morbid anxiety in patients with COPD and focusses upon the prevalence and relevance of anxiety disorders. Existing anxiety scales that are used in clinical and research settings are also critically discussed.

## Chapter 2 : CO-MORBID ANXIETY IN PATIENTS WITH COPD

*“Worry is a thin stream of fear trickling through the mind. If encouraged, it cuts a channel into which all other thoughts are drained.”*

Arthur Sommers Roche

### 2.1 INTRODUCTION

In line with the aim and objectives of this thesis, the following chapter gives a concise overview of issues relating to co-morbid anxiety disorders in patients with COPD. First, a general introduction to anxiety in both a clinical and psychological context is provided. Second, the prevalence of clinically significant symptoms of anxiety and specific anxiety disorders among patients with COPD are examined. Third, a review of the aetiology and pathophysiology of co-morbid anxiety is presented, and key theories relating to the mechanisms of anxiety in patients with COPD are explored. Fourth, in order to outline the relevance of anxiety disorders in patients with COPD, the impact of anxiety upon key health outcomes in patients with this condition are evaluated. Fifth, the recommended management of co-morbid anxiety in patients with COPD is examined. Finally, the detection of anxiety in this patient group is explored and key anxiety scales and screening tools are critically evaluated.

## 2.2 ANXIETY: AN OVERVIEW

Anxiety is a universal human experience and refers to a variety of concepts, including a mental state, a drive, a response to a particular situation, a personality trait, the cause of behaviour, and a psychiatric disorder (McDowell, 2006). Thus, the diverse nature of anxiety ensures that providing a definition in a clinical sense is complicated. Perhaps the most widely recognised clinical definition of anxiety is provided in the Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition-Text Revision (DSM-IV-TR) which considers anxiety to be:

*"... apprehensive anticipation of future danger or misfortune accompanied by a feeling of dysphoria or somatic symptoms of tension."* (APA, 2000: 820)

This definition alludes to the multi-faceted nature of anxiety and the emotional, somatic and behavioural symptoms that can present. Keedwell and Snaith (1996) provide a more detailed definition of anxiety in a clinical context that further highlights the complex nature of the construct:

*"The term encompasses a specific mood equivalent to fear, feelings of insecurity and apprehensive anticipation, content of thought dominated by disaster or personal incompetence, increased arousal or vigilance, a sense of respiratory constriction leading to hyperventilation and its consequences, muscular tension causing pain, tremor and restlessness, and a variety of somatic discomforts based*

*upon over activity of the autonomic nervous system”* (Keedwell & Snaith, 1996: 177).

Although Keedwell and Snaith (1996) include the term *fear* in their definition, fear may be considered to be an emotion that is related to the response to immediate danger i.e., fight or flight, that occurs after exposure to a stimulus. Anxiety on the other hand, is considered to be apprehension over potential future danger; a future-oriented state (McDowell, 2006).

The symptoms of anxiety broadly fall within two categories: non-somatic and somatic. Non-somatic symptoms of anxiety include an affective response often characterised by feelings of apprehension or arousal, a behavioural response such as situational avoidance or pacing, and a cognitive response that often includes memory problems or confusion. Somatic anxiety is characterised by a physiological response of hyperarousal, often involving symptoms such as sweating, heart palpitations or breathlessness. A recent study by Simms et al. (2012) explored the anxiety symptoms reported by 5433 primary care patients from 14 countries as recorded in the WHO’s Collaborative Study of Psychological Problems in General Health Care (Üstün & Sartorius, 1995). The authors found 25 core anxiety symptoms representing a range of somatic and non-somatic symptoms (see Table 2.1).

Table 2.1: Anxiety symptoms identified by Simms et al. (2012)

Non-somatic	Somatic
Mentally tense	Difficulty swallowing/felt as if choking
Difficulty concentrating because of worry	Trembly or shaky
Might lose control of self	Lump in throat
Nervous or anxious	Aware of heart pounding or racing
Unusually restless	Feeling of tightness in the chest
Difficulty relaxing	Feel muscles are tense
Felt unreal	Feel dizzy or light-headed
Feeling worried	Difficulty with breathing
Afraid that something terrible might happen	Hot or cold sweats
Trouble falling asleep because of worry	Dry mouth
Continually irritable	Discomfort or pain in chest or belly
Easily startled	
Fears of crowds, traveling, leaving home	
Sudden situational fear/anxiety	

Whilst all people experience anxiety to some degree, most do not develop long-term anxiety disorders. Chronic, persistent or severe anxiety are typically classified, in terms of a medical approach, into one of the specific anxiety disorders (PD or GAD, for example), such as those proposed by the DSM-IV-TR criteria (APA, 2000) or International Classification of Diseases-10 (ICD-10; WHO, 1992). This categorical system allows clinicians to decide whether or not to treat the patient. However, McDowell (2006) posits that psychologists, in contrast to medical doctors, typically take a dimensional approach to anxiety, which treats the associated symptoms of anxiety on a continuum of severity. This distinction is characterised by the two styles of measurement: the medical model of dichotomous case or non-case, categorised by a clinical diagnosis, and the psychological model of ordinal markers of symptom severity, often undertaken using scales and questionnaires.



### *2.2.1 MARKERS OF ANXIETY*

The experience of anxiety is composed of intricate interactions between cognitive, emotional and physiological experiences (Barlow et al. 1996). These cognitive, emotional and physiological changes are linked by their expression of a state of hypervigilance which is the cardinal indicator of anxious mood and behaviour (Eysenck, 1992). It has been suggested that the mechanisms underlying anxiety are closely related to the fear response, a biological process which rapidly detects environmental threat and responds accordingly e.g., in the “flight or fight” response (Lang et al. 2000). This response involves the recruitment and coordination of cognitive, motor, autonomic and endocrine systems (Lang et al. 2000). As a result, anxiety can be expressed in multiple systems that are linked together in a neural network (Lang, 1988). Anxiety can therefore be identified through a variety of markers including through the cognitive-language system (e.g., expressions of worry), through the motor-behavioural system (e.g., avoidance behaviours or decreased activity), and through physiological systems which may include markers such as elevated heart rate or increased activity in the amygdala (see for example Roth, 2005). The following section provides an overview of the psychophysiological mechanisms associated with anxiety and identifies the specific markers of anxiety that underly the non-somatic approach to anxiety markers chosen in this thesis.

Non-somatic markers of anxiety include cognitive, emotional and behavioural components. Broadly speaking, cognitive anxiety involves the apprehensive anticipation of future danger and the mental pre-occupation over an anxiety-inducing event (APA, 2000; Barlow et al. 1996). Thus cognitive anxiety can be detected using the cognitive-language system through subjective markers such as feelings of worry, rumination and irritability, for example (APA, 2000).

Anxiety may also have an emotional involvement, with anxiety leading to feelings of fear, sadness and helplessness, associated with a reduced ability to effectively cope with the situation at hand (Barlow et al. 1996). Obvious behavioural manifestations of anxiety include avoidance and escape and both may be considered as indirect markers of anxiety that have been conceptualised as coping strategies (McLean & Woody, 2000). Escape involves fleeing from the scene when confronted with a fear stimulus, becoming avoidance when specific situations are associated with the fear stimulus and avoided in anticipation (McLean & Woody, 2000). The cognitive and emotional distress of anxiety is often accompanied by a somatic physiological activation (arousal) response whose features can be explained as preparation for physical activity (Roth, 2005). This physiological response occurs through stimulation of the sympathoadrenal and endocrine systems.

The activation of the sympathetic division of the autonomic nervous system occurs when noradrenaline and norepinephrine release in the brain, triggered by anxiety-eliciting events causes an upregulation of sympathetic functions. It has been proposed that the ascending noradrenergic system originating from the locus ceruleus is the core around which feeling of anxiety are organised

(Redmond & Huang, 1979). Some LC neurons project to the paraventricular nucleus (PVB) in the hypothalamus and activate the hypothalamic-pituitary-adrenal (HPA) axis triggering the stress response associated with increased anxiety (Steimer, 2002). Other LC neurons project to other key structures involved in the anxiety response including the amygdala (which plays an important role in fear-response), pre-frontal cortex, the bed nucleus of the stria terminalis (thought to be important in free-floating anxiety), the hippocampus, the periaqueductal gray, the hypothalamus, the thalamus and the nucleus tractus solitarius (Steimer, 2002; Stein, 2003).

In addition to the acute autonomic response, a long-term stress response occurs involving the hypothalamic-pituitary-adrenal (HPA) axis, whose purpose is to increase the amount of usable energy in the body. The hypothalamus releases adrenocorticotrophic hormone (ACTH) which stimulates the adrenal cortex to synthesize and release glucocorticoids (e.g., cortisol and cortisone) into the bloodstream (Graeff, 2007). Glucocorticoids cause the breakdown of triglycerides, glycogen and protein into usable forms of energy such as free fatty acids, glucose and amino acids.

Neurological and endocrine responses which accompany anxiety result in a number of physiological markers of anxiety including increased sweating, heart rate, blood pressure, dilation of the pupils, trachea, and bronchi and increased respiratory rate (Gelenberg, 2000; Rosen & Shulkin, 1998). However, in anxiety, the absence of a 'real' threat renders these physiological changes a source of

great discomfort, contributing to further anxiety and impairing social functioning (Barrett & Armony, 2006).

The autonomic response to anxiety has been widely studied and it has been proposed that changes in the sympathetic branch of the autonomic nervous system may be a key element in the development of anxiety disorders (Berntson et al. 1998). However, the relationships between anxiety and autonomic function are far from simple and this is likely to be a reflection of the diversity of anxiety disorders, the complex nature of central autonomic control and multiple neural systems and processes involved in anxiety states (Bernston et al. 1998). A recent review by Graeff (2007) highlights that anxiety (GAD) and panic (PD) are pathologically distinct and that specific neurobiological systems are involved in each disorder. While GAD activates both the HPA and sympathoadrenal axis, panic attacks appear to cause significant sympathetic activation, but have little effect on the HPA axis.

The pathophysiology of specific anxiety disorders is complex and is thought to involve abnormalities in a variety of systems including neurochemical, neuroendocrine, neurophysiological and neuroanatomical systems. PD is characterised by mild to moderate baseline levels of chronic anxiety which have been associated with abnormalities in cerebral blood flow and glucose metabolism in the hippocampus and parahippocampal gyrus, although the direction of this regional asymmetry is still contended (see Charney & Drevets, 2002 for a thorough review). Similarly, chemically induced PAs in laboratory settings have identified increased cerebral blood flow in the anterior insula,

anteromedial cerebellum and the midbrain (Charney & Drevets, 2002). Other findings indicate that morphometric and morphological abnormalities in the temporal lobe may also exist in patients with PD (Ontiveros et al. 1989; Uchida et al. 2003). The neurobiology of GAD may involve a number of neurotransmitters and systems including the gamma-aminobutyric acid (GABA)/benzodiazepine complex, norepinephrine, serotonin, cholecystikinin, corticotropin-releasing factor, the HPA axis, and neurosteroids (see Connor & Davidson, 1998 for a review).

The pharmacotherapy for anxiety disorders is focussed primarily on two drug groups: benzodiazepines and selective serotonin reuptake inhibitors (SSRIs)/serotonin and noradrenaline reuptake inhibitors (SNRIs).

Benzodiazepines bind to specific sites on the  $\gamma$ -aminobutyric acid (GABA)-receptor, thus potentiating the effect of the inhibitory neurotransmitter GABA. SSRIs inhibit the reuptake of serotonin at the presynaptic membrane by the serotonin (5-HT), thus increasing synaptic concentration of the neurotransmitter, whilst SNRIs inhibit the reuptake of both serotonin and noradrenaline (Koen & Stein, 2011). Traditional approaches to GAD and PD management have advocated the use of benzodiazepines (e.g., diazepam) and antidepressants (e.g., imipramine and trazodone) for first line medical management (Connor & Davidson, 1998). However, there is growing evidence to support the efficacy and tolerability of SSRIs (e.g., fluoxetine and citalopram) for GAD and PD amongst other anxiety disorders, although there remains significant debate regarding optimal dosing, dependence, duration of use and discontinuation syndrome (Koen & Stein, 2011). Despite these limitations,

Benzodiazepines, continue to play an important role in the treatment of anxiety disorders, particularly because of their efficacy and rapid onset of action.

### *2.2.2 STATE AND TRAIT ANXIETY*

Evolving definitions of anxiety in the 1950s and 60s led to the development of the idea that anxiety is a multidimensional concept, which exists as two distinct entities: state and trait anxiety (Cattell and Scheier, 1958; Spielberger et al., 1966). Cattell and Scheier (1958) were the first to distinguish between state and trait anxiety using factor analytical techniques. They describe trait anxiety as an enduring disposition and state anxiety as a temporary and changeable phenomenon. Trait anxiety involves a tendency to react to certain situations in a certain manner, to experience anxious symptoms in non-threatening situations, and to be vulnerable to stress. State anxiety, on the other hand, is a discrete response to a specific threatening situation and involves transitory unpleasant feelings such as worry, apprehension and tension, often associated with a physiological arousal response (McDowell, 2006; Spielberger et al., 1966).

People with high trait anxiety are assumed to be prone to experience state anxiety. However, work by Endler and colleagues (1991; 2001) posits that trait and state anxiety are also multidimensional (see Figure 2.1). Endler et al. (1991) conducted a factor analysis (FA) to clarify the empirical relationship between state and trait anxiety and identified four distinct aspects of trait anxiety: social evaluation, physical danger, ambiguous situations and daily routines. In addition, they identify two facets of state anxiety: cognitive-worry

and autonomic-emotional. Social evaluation trait anxiety measures an individual's predisposition to experience an increase in state anxiety in situations when one is being observed by others. Physical danger relates to situations where one may be physically hurt. Ambiguous trait anxiety refers to situations which are new to an individual. Finally, daily routines trait anxiety is related to situations that involve an individual's daily routines and are innocuous (Endler et al., 1991; 2001).

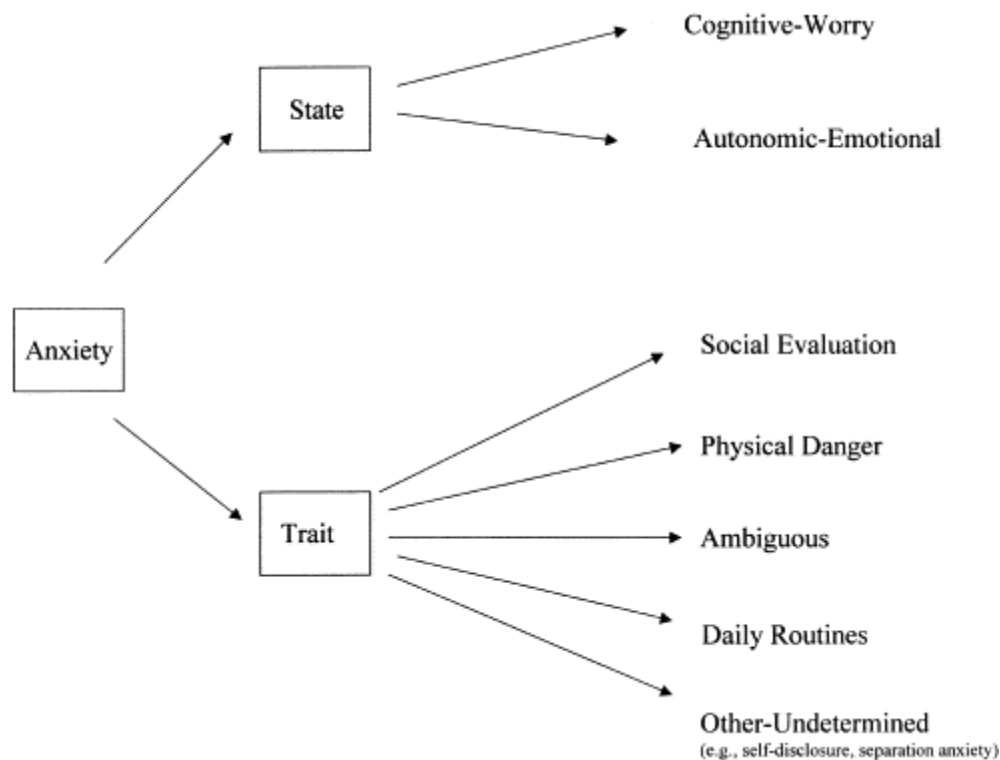


Figure 2.1: Multidimensionality of state and trait anxiety. Reproduced with permission from Endler & Kocovski (2001)

According to the multidimensional state-trait anxiety model, for an increase in state anxiety to occur, the threatening situation must be congruent with the corresponding dimension of trait anxiety. In other words, levels of state anxiety

are dependent upon both the person (trait anxiety) and the stressful stimulus (Endler et al., 2001). For example, an individual with high physical danger trait anxiety would interact with a physical danger situation by reporting high state anxiety. However, it is posited that the interactions do not occur between other dimensions of the trait anxiety. Therefore, for example, high physical danger trait anxiety would not result in elevated state anxiety in a social evaluation situation (Endler et al., 1991; 2001).

### *2.2.2 COGNITIVE THEORIES OF ANXIETY*

In keeping with cognitive theories of anxiety, biases in information processing play a key role in the aetiology and maintenance of anxiety disorders. According to attentional control theory (ACT) (Eysenck et al. 2007), anxiety disrupts the balance between the goal-driven or stimulus-driven systems. The goal directed attentional system is managed by expectations, knowledge and current goals and represents top-down attentional control. The stimulus-driven system, on the other hand, represents bottom-up attentional control which is guided by behaviourally relevant salient sensory events (Corbetta & Shulman, 2002).

Eysenck and colleagues (2007) propose that anxiety modulates the balance between the two systems leading to an increase in influence from the stimulus-driven attentional system and a decreased influence of the goal-directed attentional system.

ACT suggests that anxiety affects processing efficiency to a greater extent than performance effectiveness due to the effects of anxiety on the attentional



control of inhibition, updating and shifting functions. A key assumption of ACT is that anxiety increases the allocation of attention to threat-laden stimuli, reducing attentional focus on the current task unless it is threat-laden. As a result, anxious individuals preferentially allocate attentional resources to threatening stimuli such as worrisome thoughts (e.g., meta-worry) or external threatening distractions (Eysenck et al. 2007).

Eysenck's earlier theory of anxiety (Eysenck, 1997) states that the level of anxiety experienced by an individual depends on the amount of attention given to the external environment, one's own physiological activity, one's own behaviour, and negative cognitions about future threats. Individuals with high trait anxiety are thought to exhibit attentional (e.g., attending to threat-laden rather than neutral stimuli) and interpretive (e.g., interpreting ambiguous stimuli or situations in a threatening fashion) biases. However, as Derakshan et al. (2007) asserts, some individuals may exhibit different attentional bias that leads them to avoid negative states in a repressive coping style. Such individuals demonstrate low levels of trait anxiety (measured by self-report) and high defensiveness, yet there are clear discrepancies between their self-report trait anxiety and objectively measured physiological and behavioural indicators. These individuals may be considered to be repressing their subjective experience of anxiety, despite tendencies to respond physiologically and behaviourally in a manner suggestive of high levels of perceived threat (Weinberger, 1990). Repressors show biases indicating that they avoid attending to threat-laden stimuli when presented concurrently with neutral stimuli. They also tend to interpret ambiguous stimuli and situations in a non-

threatening fashion and avoid retrieving threatening information (Derakshan et al. 2007). Another key assumption underlying the repressive coping style is that these avoidant processes exist in relation to both external and internal stimuli, such as their own physiology, behaviour and emotion-related cognitions (Derakshan et al. 2007).

Previous work by Weinberger, Schwartz and Davidson (1979) has identified four groups of individuals based on their self-reported trait anxiety (in this case the Taylor Manifest Anxiety Scale) and defensiveness (measured using the Marlowe-Crowne Social Desirability Scale; Crowne & Marlowe, 1964). The four groups were: 1) low-anxious (low on trait anxiety and low on defensiveness); 2) repressors (low on trait anxiety and high on defensiveness); 3) high anxious (high on trait anxiety and low on defensiveness); and 4) defensive high anxious (high on trait anxiety and high on defensiveness). Weinberger (1990) asserts that repressors report lower relative self-reported anxiety than physiological or behavioural anxiety because they are self-deceivers, as opposed to deceiving others. Therefore, these individuals avoid experiencing anxiety on a conscious level. The attentional and interpretative biases of these individuals may explain these differences. For example, high anxious individuals may have selective attentional biases which lead them to attend to threat-laden stimuli and interpretative biases that lead them to interpret ambiguous stimuli in a threatening manner. Conversely, repressors may have selective attentional biases that lead them to avoid attending to threat-laden stimuli and interpretative biases that lead them to avoid interpreting ambiguous stimuli in a threatening manner, thus “protecting” them from consciously experiencing

anxiety (Derakshan et al. 2007; Derakshan & Eysenck, 1999; Derakshan & Eysenck, 2001).

In an attempt to explain the discrepancies in reported anxiety and objective markers of anxiety, Derakshan and co-workers (2007) proposed a vigilance-avoidance theory. The key assumption of this theory is that there are two successive stages on processing when repressors are exposed to self-relevant threats. The first stage (vigilance) is a rapidly occurring stage which involves automatic and non-conscious processes and is thought to produce behavioural and physiological anxiety responses. The second stage (avoidance) incorporates avoidant cognitive biases which are important in producing low self-reported anxiety. Thus, repressors are thought to make use of avoidance cognitive biases after some processes indicating that a stimulus poses a self-relevant threat (Derakshan et al. 2007).

The repressive coping style is of particular concern in the detection and management of anxiety as small or no correlations are found between self-reported, physiological and behavioural anxiety (Eysenck, 1997). However, when repressors are removed from these analyses, the expected relationships between the markers are found. This might suggest that repressors could be missed when screening using self-report scales where patients are asked to report the severity of their symptoms. This may be of particular concern in some chronic diseases where repressors may form a large part of the population. Previous studies have identified a high rate of repressors among patients with chronic respiratory diseases including lung cancer and asthma

(Prasertsri et al. 2011, Gonzalez-Freire et al. 2010). The repressive coping style is associated with poor prognosis, a reluctance to seek social support and engage with psychotherapy (Phipps & Steele, 2002). High rates of defensive high anxious individuals have also been identified amongst other chronic disease populations, particularly in chronic lower back pain and chronic fatigue syndrome (Creswell & Chalder, 2001; Lewis et al. 2012). The defensive high anxious coping style has also been associated with detrimental health, particularly via increased endorphin levels in the brain which can lead to immunocompetence (Jamner et al. 1988).

### *2.2.3 TYPES OF ANXIETY DISORDER*

In terms of a medical perspective, excessive anxiety is a central symptom of a number of psychological disorders, particularly the clinical anxiety disorders. Seven types of anxiety disorder are defined by the most recent DSM-IV-TR (APA, 2000) criteria: PD with or without agoraphobia; agoraphobia without a history of PD; social phobia; specific phobia; GAD; obsessive-compulsive disorder (OCD), and post-traumatic stress disorder (PTSD). The following section provides a brief description of the DSM-IV-TR anxiety disorders and their corresponding symptoms and features.

#### **2.2.3.1 Panic disorder (PD) with or without agoraphobia**

The central feature of PD is the occurrence of panic attacks (PA) which are defined as discrete periods of intense fear or discomfort. DSM-IV-TR (APA,

2000) criteria for PA require that four of the 13 symptoms listed in Table 2.2 must be present during the attack.

**Table 2.2: Symptoms of panic attack according to DSM-IV-TR (APA, 2000)**

1	Shortness of breath and smothering sensations
2	Choking
3	Palpitations or accelerated heart rate
4	Chest discomfort or pain
5	Sweating
6	Dizziness, unsteady feelings or faintness
7	Nausea or abdominal distress
8	Depersonalisation or derealisation
9	Numbness or tingling sensations
10	Flushes or chills
11	Trembling or shaking
12	Fear of dying
13	Fears of going crazy or doing something uncontrolled

For a diagnosis of PD to be confirmed, the PAs must have been recurrent and unexpected and at least one of the attacks must have been followed by 1 month or more of: persistent concerns about having additional attacks; worry about the implications of the attack or its consequences, or a significant change in behaviour related to the attacks (APA, 2000). PD with agoraphobia refers to PA that are followed by pervasive avoidance behaviours, especially avoidance of public places or other “unsafe” situations (Rachman, 2004).

#### **2.2.3.2 Agoraphobia without a history of panic disorder (PD)**

Agoraphobia refers to a fear of being in public places from which escape might be difficult. The symptoms are similar to phobic anxiety disorders, however,

symptoms such as depression and depersonalisation are found more often in agoraphobia than in other phobias (Gelder et al., 1996). Although many situations might trigger agoraphobic cognitions, three common themes prevail: distance from home, overcrowding and confinement. Individuals with this particular anxiety disorder typically experience panic-like symptoms that are often sub-clinical in intensity (APA, 2000).

#### **2.2.3.3 Social phobia**

Social phobia is characterised by inappropriate anxiety experienced in situations in which the individual is observed and could, therefore, be criticised (Gelder et al., 1996). This particular phobia is typified by avoidance of social situations, particularly behaviours such as avoiding conversations or entering social environments e.g., meetings, canteens etc. Two common physiological symptoms of social phobia are trembling and blushing (APA, 2000).

#### **2.2.3.4 Specific phobia**

In a similar vein to social phobia, individuals who experience specific phobia demonstrate inappropriate anxiety to a specific object or situation. The fear that accompanies specific phobias is especially intense and persistent. Common phobias include fear of spiders, flying or dentists (Gelder et al., 1996; Rachman, 2004).

#### **2.2.3.5 Generalised anxiety disorder (GAD)**

Symptoms of GAD are, as the name indicates, not restricted to or strongly predominating in any particular set of circumstances (Gelder et al., 1996). The cardinal signs of GAD are worry and apprehension, which are prolonged and difficult to control, motor tension, such as restlessness or inability to relax, and autonomic hyperactivity, such as sweating or dry mouth (see Table 2.3). Other symptoms include sleep disturbance (both trouble falling asleep and staying asleep), poor concentration and irritability (Gelder et al., 1996). For a diagnosis of GAD to be given, symptoms must have occurred more days than not for a period of at least 6 months (APA, 2000). According to DSM-IV-TR criteria, the worries that underlie GAD are not focussed upon specific elements such as being embarrassed in public (social phobia) or being contaminated (OCD). Rather, worries are often widespread, possibly relating to issues such as finances or health, or minor matters such as household chores or being late for appointments (APA, 2000).

Table 2.3: Symptoms of GAD according to Gelder et al. (1996)

Symptom category	Symptom sub-category	Symptom
Psychological		Fearful anticipation
		Irritability
		Sensitivity to noise
		Restlessness
		Poor concentration
		Worrying thoughts
Physical	Gastrointestinal	Dry mouth
		Difficulty swallowing
		Epigastric discomfort
		Excessive wind
		Frequent or loose motions
		Constriction in the chest
	Respiratory	Difficulty inhaling
		Overbreathing (breathlessness)
		Palpitations
	Cardiovascular	Discomfort in chest
		Awareness of missed beats
		Frequent or urgent micturition
	Genitourinary	Failure of erection
		Menstrual discomfort
		Amenorrhoea
		Tremor
	Neuromuscular system	Prickling sensations
		Tinnitus
		Dizziness
		Headache
		Aching muscles
Sleep disturbance		Insomnia
		Night terror
Other symptoms		Depression
		Obsessions
		Depersonalisation



#### **2.2.3.6 Obsessive compulsive disorder (OCD)**

OCD is characterised by obsessional thinking and compulsive behaviour, as well as anxiety, depression and depersonalisation (APA, 2000). There are a number of obsessional and compulsive symptoms including obsessional thoughts (often unpleasant words, ideas or beliefs), obsessional images (unpleasant imagined scenes), obsessional ruminations (often in the form of internal debates), obsessional doubts (such as concerns that actions may not have been completed e.g., turning off gas or locking the door), and obsessional rituals (such as washing hands or turning lights on and off multiple times). Anxiety is a key symptom of OCD and can be both reduced or elevated following obsessional actions (Gelder et al., 1996).

#### **2.2.3.7 Post-traumatic stress disorder (PTSD)**

PTSD consists of multiple symptoms that include anxiety, elevated arousal, avoidance and fear (Rachman, 2004). The term denotes an intense and often prolonged reaction to an intensely distressing experience, such as a natural disaster, or violent event. Alongside the anxiety that is common in PTSD, individuals experience intrusions that include flashbacks and distressing dreams, and exhibit avoidance behaviours such as avoiding reminders of the original event (Gelder et al., 1996; Rachman, 2004).

#### *2.2.4 DEPRESSION AND ANXIETY*

Anxiety has long been recognised as a prominent symptom of many psychiatric disorders, especially depression. It was not until the last part of the nineteenth century that anxiety disorders were classified separately from other disorders of mood (Gelder et al., 1996). Anxiety and depression frequently co-occur, with epidemiological studies suggesting that the two disorders co-present approximately 40% to 75% of the time (Clark, 1989). The USA National Comorbidity Survey found that among patients diagnosed with major depression there is a 3-fold to 8-fold increased likelihood that the patient is also suffering from a co-morbid anxiety disorder (Kessler et al., 1996). The prevalence of anxiety and depression in patients with COPD shows a similar picture. Kunik and colleagues found that anxiety and depression co-occurred in 26% of patients with either an anxiety or depressive disorder (Kunik et al., 2005). In addition, Yohannes and co-workers (2000a) found that 37% of patients with depression also had co-morbid clinical anxiety.

Diagnostically, the DSM-IV-TR categorises mixed anxiety-depressive disorder as the presence of anxiety and depressive symptoms of equal intensity that do not occur to the extent that justifies a diagnosis if considered separately (APA, 2000). However, patients may have clinically relevant symptoms that meet the criteria for either a depression or anxiety diagnosis. Hirschfeld (2001) suggests that co-occurring anxiety and depression typically present as one of four clinical presentations: (1) a clinical anxiety disorder with subsyndromal levels of depression, (2) major depression with subsyndromal levels of anxiety, (3) both

clinical anxiety disorder and major depression, and (4) subsyndromal mixed anxiety-depression.

Several theories have been proposed to explain the overlap of anxiety and depression and their frequent co-occurrence (Shankman & Klein, 2003). One explanation is that anxiety disorders and depression share common symptoms. For example, sleep disturbance and fatigue are considered to be symptoms of both GAD and major depressive disorder (MDD; APA, 2000). Another possibility is that anxiety and depression share a single underlying, general negative mood, rather than existing as separate dimensions (Feldman, 1993).

More recently, a number of models have been proposed that expand on Feldman's (1993) general negative mood theory (cf. Shankman & Klein, 2003): the tripartite model (Clark & Watson, 1991); the approach-withdrawal model (Davidson, 1998), and the valence-arousal model (Heller & Nitschke, 1998). Of these models, Clark and Watson's tripartite model is perhaps the most widely acknowledged, finding general acceptance particularly within adult psychiatry (e.g., Marshall et al., 2003). The model proposes that there are three underlying dimensions for anxiety and depression (see Figure 2.2). The first dimension is a higher order factor of general distress or negative affect, which is posited to be common to both anxiety and depression and is characterised by aversive emotional states such as sadness, anger and fear. The second dimension is positive affect, which represents positive emotional states such as feeling happy, enthusiastic and energetic. According to Clark and Watson (1991), patients with depression can be distinguished from those with anxiety in that

they have low positive affect, such as feelings of anhedonia or sluggishness. Finally, the third dimension is that of autonomic arousal, which represents physiological symptoms such as breathlessness or dizziness and is believed to be specific to anxiety disorders. This model helps to explain the co-occurrence of anxiety and depression, with both disorders sharing the dimension of negative affect, depression characterised by low positive affect, and anxiety – particularly panic – characterised by high autonomic arousal.

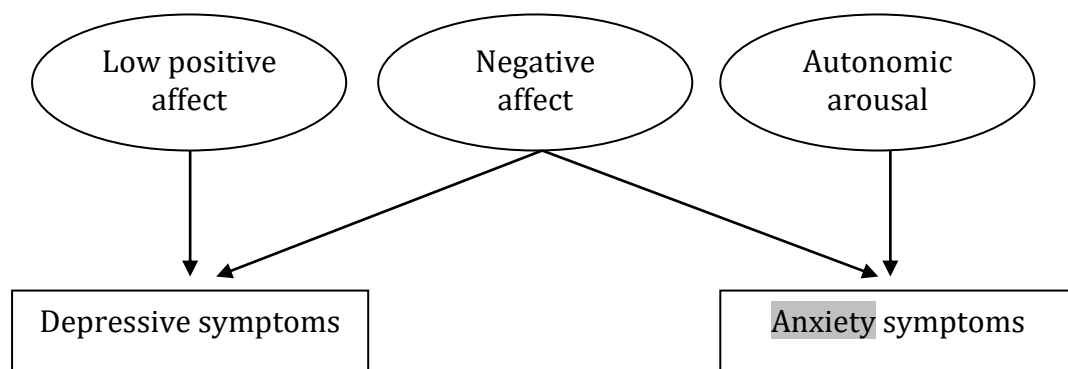


Figure 2.2: Tripartite model of anxiety and depression (Clark & Watson, 1991)

### 2.2.5 SUMMARY

Anxiety is a complex, ambiguous and multidimensional construct that has been defined in many ways; however, it is typified by feelings of apprehension and physiological arousal. Further ambiguity is provided by the evident overlap between anxiety and depression which frequently co-occur. Anxiety can be identified through a variety of markers including through the cognitive-language system the motor-behavioural system and through physiological

systems. Anxiety may be subdivided into state anxiety (transient and situation specific) and trait anxiety (enduring and multidimensional). Individuals who have a trait predisposition to a specific stimulus are likely to experience elevated situational-specific state anxiety. The dimensional model of anxiety, favoured by psychologists treats anxiety as a continuum, whilst the medical model of anxiety categorises anxiety into various clinical anxiety disorders, as exemplified by the DSM-IV-TR. Specific anxiety disorders include PD, GAD, agoraphobia without PD, specific and social phobia, OCD and PTSD.

### 2.3 PREVALENCE OF ANXIETY IN PATIENTS WITH COPD

There is little consensus on the prevalence of anxiety in patients with COPD. For example, recent literature reviews indicate that clinically significant symptoms of anxiety may be present in between 2 and 96% of patients with COPD (Brenes, 2003; Hynninen et al., 2005; Mikkelsen et al., 2004; Yohannes et al., 2010). It is likely that diverse reports on the prevalence of anxiety are a reflection of a mix of limiting factors, such as the use of a range of diagnostic procedures (including various screening tools and interview schedules), the populations sampled (e.g., inpatient and outpatient samples) and the heterogeneity of patient samples (such as variations in age, sex, disease severity etc.).

Although numerous studies have reported on the prevalence of anxiety in COPD, many of these have utilised self-report anxiety scales which identify 'likely' cases of clinical anxiety based on symptom severity, rather than diagnosis. Such studies are able to give an insight into the severity of symptoms

experienced by patients with COPD, but cases of likely anxiety are based upon cut-off scores, often varying even when using the same self-report scale. For example, studies which include the HADS-A as a screener for likely clinical anxiety, report a range of cut-off scores (e.g., Cleland et al., 2007; Gudmundsson et al., 2005; Xu et al., 2008). This is discussed in greater detail in section 2.8.1 on 'Extant scales.'

In contrast to self-report scales, psychiatric interviews are able to give a more reliable diagnosis of clinical anxiety. Psychiatric interviews are usually carried out using a structured clinical interview that is based on robust psychiatric diagnostic criteria such as the DSM-IV-TR (APA, 2000) or the ICD-10 (WHO, 1992). Psychiatric interviews allow an in-depth understanding of the patient's symptoms and therefore enable the specific classification of psychiatric disorders. Table 2.4 provides a summary of studies that report on the prevalence of clinical anxiety or specific anxiety disorders in patients with COPD.

In studies that report the overall prevalence of clinical anxiety, reports vary considerably, ranging from 10-55% (Aghanwa & Erhabor, 2001; Vögele & von Leupoldt, 2008). Similar rates have been reported in both inpatient (10-55%) and outpatient samples (13-46%) indicating that high incidence cannot be explained solely by the presence of an exacerbation-related hospitalisation and is more likely to be an enduring disease-related phenomenon (Vögele & von Leupoldt, 2008). It is unclear why reported prevalence rates for anxiety disorders in patients with COPD range so considerably. One factor may be the

heterogeneity of the samples, particularly in terms of age and sex. For example, in the ten studies included in this literature review, the mean age of participants ranged from 48.5 to 73.0 years (Aydin & Ulusahin; Yohannes et al., 2000a). The majority of studies also included mainly male samples. Five studies contained samples which were >70% male whilst only two studies had roughly equal ratios of males and females (Laurin et al., 2007; Yohannes et al., 2000a). Finally, although all studies included psychiatric diagnosis, the psychiatric classification and interview format varied between studies. The majority of studies incorporated a nosological DSM or ICD diagnostic criteria, yet one study (Yohannes et al., 2000a) utilised a computerised syndromal classification.

Table 2.4: Study characteristics for diagnosed anxiety prevalence

Study	Country	N	Age (years)	Male (%)	Participants	Interview schedule	Diagnostic tool	Prevalence of clinical anxiety (%)	Specific anxiety disorders					
									GAD (%)	PD (%)	Specific phobia (%)	Social phobia (%)	OCD (%)	PTSD (%)
<b>Aghanwa &amp; Erhabor (2001)</b>	Nigeria	30	62.9 ± 9.6	83	Inpatients	-	ICD-10	10	-	-	-	-	-	-
<b>Aydin &amp; Ulusahin (2001)</b>	Turkey	38	48.5 ± 9.4	100	Inpatients	CIDI	DSM-IV-TR	16	16	0	-	-	-	-
<b>Dowson et al. (2004)</b>	New Zealand	39	71.3 ± 7.2	41	Inpatients	-	DSM-IV-TR	-	33	41	-	-	-	-
<b>Karajgi et al. (1990)</b>	USA	50	64.9 ± 9.7	62	Outpatients	SCID	DSM-III-R	16	-	8	-	-	-	-
<b>Kunik et al. (2005)</b>	USA	204	65.9 ± 10.7	96	Outpatients (pre-screened)	SCID	DSM-IV-TR	-	19	6	13	2	1	7
<b>Kühl et al. (2008)</b>	Germany	143	67.0 ± 9.5	78	Outpatients	-	ICD-10	-	6	8	-	-	-	-
<b>Laurin et al. (2007)</b>	Canada	116	67.0 ± 8.0	47	Outpatients	ADIS-IV	DSM-IV-TR	46	19	21	27	11	2	1
<b>Vögele &amp; von Leupoldt (2008)</b>	Germany	20	62.2 ± 10.0	70	Inpatients	F-DIPS	DSM-IV-TR	55	-	40	10	5	-	-



Study	Country	N	Age (years)	Male (%)	Participants	Interview schedule	Diagnostic tool	Prevalence of clinical anxiety (%)	Specific anxiety disorders					
									GAD (%)	PD (%)	Specific phobia (%)	Social phobia (%)	OCD (%)	PTSD (%)
<b>Yellowlees et al. (1987)</b>	Australia	50	65.0 ± 9.9	64	Inpatients	-	DSM-III	34	10	24	-	-	-	2
<b>Yohannes et al. (2000a)</b>	UK	137	73.0	50	Outpatients	GMS	AGECAT	18	-	-	-	-	-	-

GAD: generalised anxiety disorder; PD: panic disorder; OCD: obsessive-compulsive disorder; PTSD: post-traumatic stress disorder; ICD-10: International Classification of Diseases-10; CIDI: Composite International Diagnostic Interview; DSM: Diagnostic and Statistical Manual of Mental Disorders; USA, United States of America; SCID: Structured Clinical Interview for DSM; ADIS-IV: Anxiety Disorders Interview Schedule for DSM-IV; F-DIPS: Diagnostisches Interview für Psychische Störungen-Forschungsversion; UK, United Kingdom; Geriatric Mental State Schedule

Specific anxiety diagnoses including GAD, PD (with and without agoraphobia), specific phobia and social phobia are particularly prevalent and appear to occur at a greater rate among patients with COPD compared with the general population (Pirkola et al., 2005; Wolitzky-Taylor et al., 2010). For example, between 6% and 33% of patients with COPD appear to suffer from GAD (Aydin & Ulusahin, 2001; Downson et al., 2004; Kunik et al., 2005; Köhl et al., 2008; Laurin et al., 2007; Yellowlees et al., 1987), compared to 1-7% of community-based older adults (Wolitzky-Taylor et al., 2010).

The prevalence of PD (see Table 2.4) also appears to be noticeably higher in patients with COPD than among the general population. Studies indicate that between 0% and 41% of COPD patients may have PD (Aydin & Ulusahin, 2001; Dowson et al., 2004). In three recent studies with large sample sizes (n=116-204), prevalence of PD (with or without agoraphobia) was found to be 6-21% (Köhl et al., 2008; Kunik et al., 2005; Laurin et al., 2007). In contrast, the prevalence of PD (with or without agoraphobia) among older adults is between 0.1 and 2% (Kirmizioglu et al., 2009; Wolitzky-Taylor et al., 2010).

Kunik and colleagues (2005) conducted a detailed study of specific anxiety diagnoses in patients with COPD in which patients who demonstrated significant anxiety on the BAI (total score  $\geq 16$ ) underwent a secondary structured clinical interview to establish a psychiatric diagnosis. Their results indicated that specific phobia was the second most prevalent anxiety disorder (behind GAD), affecting 13% of pre-screened COPD patients. Other studies also report a high prevalence of phobic anxiety disorders among this patient group

including specific phobia (prevalence of 10-27%) and social phobia (prevalence of 5-11%; Laurin et al., 2007; Vögele & von Leupoldt, 2008).

Among elderly populations, phobias are the most prevalent psychiatric disorder after cognitive disorders (Wittche & Fehm, 2001). Specific phobia is thought to occur in up to 10% of older people, and social phobia, although less prevalent, is believed to affect up to 6% of older people (Wolitzky-Taylor et al., 2010). The prevalence of phobic anxiety disorders in patients with COPD is higher than among healthy age-matched samples but it is not clear why this might be. It is possible that a high prevalence of specific phobia and social phobia is due to increased self-consciousness and embarrassment (due to overt signs of their respiratory disease e.g., breathlessness, sweating or use of ambulatory oxygen), or increased sensitivity to situations of perceived danger (e.g., being without medication or becoming acutely breathless (Arnold et al., 2007; Willgoss et al., 2011).

Anxiety disorders including PTSD and OCD are less prevalent than other anxiety disorders in patients with COPD. The prevalence of OCD and PTSD is approximately 1-2% in patients with COPD (Laurin et al., 2007; Yellowlees et al., 1987) and is similar to that found among the general elderly population (0.1-3.5%; Wolitzky-Taylor et al., 2010). It is not clear why the prevalence of certain anxiety disorders (GAD, PD and phobias) is higher in patients with COPD whilst rates of PTSD and OCD remain normal. One reason may be that unlike GAD, PD and phobias, PTSD and OCD do not share common aetiological features with COPD. PTSD often originates from a specific traumatic event, whilst OCD

typically has an early onset (beginning in adolescence early adulthood).

Therefore, it is unlikely that the risk of developing these specific disorders will be elevated with the development of COPD.

Even conservative estimates of anxiety prevalence in patients with COPD are generally higher than that found in the general population or matched healthy controls (Aghanwa & Erhabor, 2001; Pirkola et al., 2005). Aghanwa and Erhabor (2001) compared the prevalence of clinical anxiety among COPD patients to matched clinical comparisons including hypertensive patients and healthy controls (see Table 2.5). Patients with COPD and hypertension displayed a similar incidence of anxiety (10%) that was significantly higher than among patients with no major health issues (3%). Other studies indicate that the prevalence of clinical anxiety is significantly higher in COPD patients than among individuals with other diseases including chronic orthopaedic disease and those with recently diagnosed tuberculosis (Aydin & Uluşahin, 2001; Vögele & von Leupoldt, 2008). Finally, one study found comparable prevalence of PD and GAD in patients with COPD and their spouses. Kühl et al. (2008) found that 8% of patients with COPD had PD and/or agoraphobia compared to 5% of spouses. In addition, 6% of patients with COPD had GAD compared to 7% of spouses.

Table 2.5: Prevalence of clinical anxiety in COPD compared to comparison groups

Study	Populations compared	Prevalence of clinical anxiety (%)
Aghanwa & Erhabor (2001)	<i>COPD (n=30)</i>	10
	Hypertensives (n=30)	10
	Healthy controls (n=30)	3
Aydin & Ulusahin (2001)	<i>COPD (n=38)</i>	16
	Recently diagnosed TB (n=42)	2
	Defaulted TB (n=38)	3
	Multi-drug resistant TB (n=39)	15
Vögele & von Leupoldt (2008)	<i>COPD (n=20)</i>	55
	Chronic orthopaedic disease (n=20)	20

COPD, chronic obstructive pulmonary disease; TB, tuberculosis

In addition to studies exploring prevalence rates through psychiatric diagnosis, there are numerous studies providing estimations of anxiety prevalence based on the severity of anxiety symptoms as identified in self-report scales. Table 2.6 presents a non-exhaustive list of reported anxiety prevalence from major studies published during the last few decades. Among these studies are a number of multi-centre trials that permit large samples to be recruited (e.g., Xu et al., 2008). However, even among large homogenous samples of patients with COPD, estimated prevalence of clinical anxiety varies markedly. For example, in a recent study exploring the impact of anxiety and depression on hospitalisations and exacerbations, Xu and colleagues (2008) report that 10% of COPD patients had likely clinical anxiety at baseline as identified using the HADS-A (total score  $\geq 11$ ). In comparison, a similar study by Gudmundsson et al. (2005) which also incorporated the HADS-A found that 41% of the sample were likely cases of clinical anxiety (based on a cut-off score of  $\geq 8$ ). It is likely that the variation in HADS-A cut-off score is at least partly responsible for the disparity

in prevalence estimates between these studies and highlights the difficulty in establishing a benchmark prevalence figure.

The diverse prevalence estimates for anxiety among patients with COPD may be explained, in part, by the various scales and cut-off scores that have been used. A number of self-report anxiety scales have been used to report the prevalence of likely clinical anxiety in patients with COPD, including the HADS-A, the BAI and the State-Trait Anxiety Inventory (STAI; Spielberger et al., 1983). It is also evident that the cut-off scores used to distinguish a case of likely clinical anxiety are not consistent. For example, studies that utilise the HADS-A to report likely anxiety prevalence have used a variety of cut-off scores, ranging from 8 to 11 (e.g., Cleland et al., 2007; Gudmundsson et al., 2005; Xu et al., 2008). Generalising these findings to the wider COPD population should, therefore, be carefully considered.

Table 2.6: Prevalence of likely anxiety in patients with COPD

Study	Country	N	Screening tool	Prevalence (%)
Bosley et al. (1996)	UK	76	HADS	28
Cleland et al. (2007)	UK	110	HADS	33
Di Marco et al. (2006)	Italy	202	STAI	19
Dowson et al. (2001)	New Zealand	79	HADS	50
Engström et al. (1996)	Sweden	68	HADS	13
Funk et al. (2009)	Austria	122	HADS	49
Gudmundsson et al. (2005)	Sweden, Norway, Finland, Iceland, Denmark	406	HADS	41
Gurney-Smith et al. (2002)	UK	30	HADS	53
Kim et al. (2000)	USA	43	BAI	33
Lewis et al. (2007)	UK	182	HADS	25
Sutton et al. (1999)	USA	37	HADS	57
Walke et al. (2007)	USA	74	ESAS	32
Withers et al. (1999)	UK	95	HADS	29
Xu et al. (2008)	China	491	HADS	10

HADS, Hospital Anxiety and Depression Scale, STAI, State-trait Anxiety Inventory; BAI, Beck Anxiety Inventory; ESAS, Edmonton Symptom Assessment System.

### 2.3.1 SUMMARY

Although it is difficult to reach a consensus on the prevalence of anxiety in patients with COPD, it is clear that it is more common in this condition than among both the healthy population, and among patients with other chronic diseases. Even the most conservative estimates of anxiety prevalence from studies that utilise psychiatric interviews suggest that anxiety disorders, especially GAD, PD, and phobias, are common in patients with COPD.

Amongst the most prevalent anxiety disorders are PD and GAD, which appear to be considerably more common among patients with COPD than in the general

population. Although the prevalence of phobic anxiety disorders also appears to be high in patients with COPD, it is evident that these disorders are also among the most common in healthy elderly patients. The prevalence of OCD and PTSD do not appear to be significantly elevated in patients with COPD.

## 2.4 AETIOLOGY AND PATHOPHYSIOLOGY OF ANXIETY IN PATIENTS WITH COPD

Although there are a number of theories that attempt to explain the elevated levels of anxiety in patients with COPD, the exact aetiology of anxiety in this patient group remains poorly understood. Muller et al. (2005) suggests that the elevated levels of anxiety in patients with chronic medical conditions are a result of four possible associations: a physiological consequence of the medical disorder; a psychological reaction to the experience of living with the medical disorder; a side effect of treatment, or a chance occurrence. Broadly speaking, theories explaining the elevated anxiety in patients with COPD mirror those posited by Muller and colleagues. It is likely, however, that the association between anxiety and COPD is both multifactorial and bidirectional (Jain & Lolak, 2009).

There is growing evidence for a physiological explanation of anxiety in COPD that can be explained by the presence and severity of dyspnoea. For example, recent brain imaging studies have found that the affective dimension of dyspnoea is processed in areas of the brain that are also activated by sensations of fear of anxiety (Carrieri-Kohlman et al., 2010; LeDoux, 2003; von Leupoldt et



al., 2009). This adds support to the notion that there might be a common aetiology between anxiety and symptoms of COPD such as dyspnoea.

Dyspnoea is a central symptom in both COPD and anxiety (particularly PAs) and Klein (1993) proposes that PAs in patients with respiratory disease are often a result of a false suffocation alarm. As panic can be reliably induced in laboratory settings, it has been the focus of a great deal of psychophysiological research. Klein (1993) found that increasing brain CO<sub>2</sub> and lactate in the laboratory were both indicators of potential asphyxiation that can lead to a false suffocation alarm and, therefore, to PAs. This may explain why PAs are so common in patients with COPD, who often have elevated pCO<sub>2</sub>. More recently, Beck and colleagues (1999; 2000) found that hypoxia, another indicator of potential suffocation, has a panicogenic response.

The majority of research exploring the association between anxiety and COPD is focussed upon PAs and PD and a number of theoretical (and often contradictory) models have been proposed to explain this relationship. Within this field, the most widely accepted model is the cognitive model of panic proposed by Clark (1986). According to Clark's model (Figure 2.3), a PA results when ambiguous bodily sensations are interpreted as imminently catastrophic, creating a positive feedback loop (Livermore et al., 2012). Catastrophic thoughts may be misinterpretations or over-interpretations of symptoms, and are often applied to shortness of breath in patients with COPD. There is growing evidence for the cognitive model of panic, supported by studies which demonstrate that although all patients with COPD experience shortness of

breath, it is those with catastrophic misinterpretations who experience heightened symptoms of panic and elevated prevalence of anxiety disorder (Livermore et al., 2010; 2012).

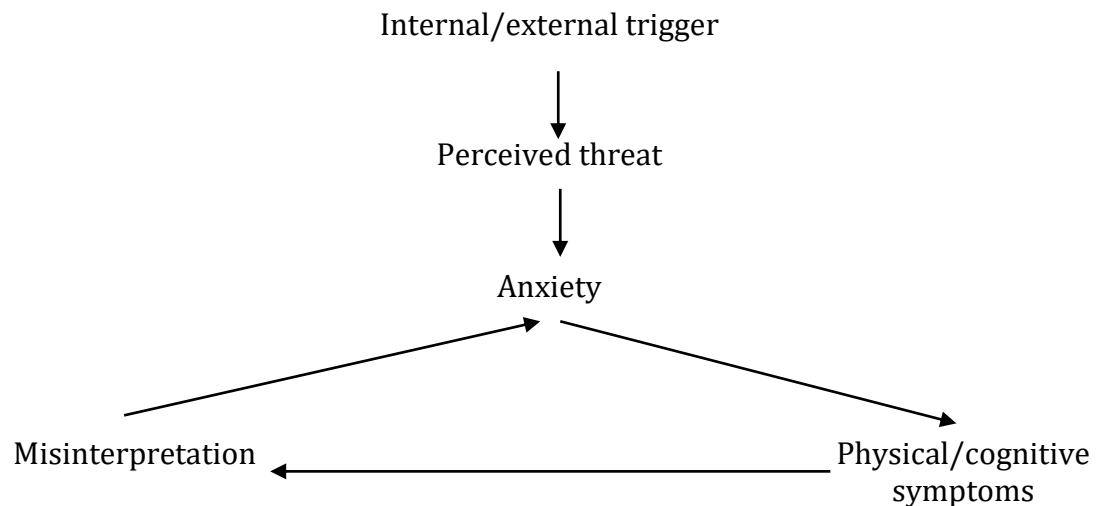


Figure 2.3: Clark's cognitive model of panic (adapted from Clark, 1986)

An opposing model to that proposed by Clark is Ley's 'dyspneic-fear' theory (1989). This model was an adaptation on an earlier hyperventilation theory of panic (Ley, 1985) and was based on findings questioning the role of catastrophic cognitions in panic, namely that catastrophic cognitions follow fear, that some patients experience panic without fearful cognitions, and that patients experience panic attacks during non-dreaming stages of sleep (Margraf et al., 1987; Rachman et al., 1987; Wolpe & Rowan, 1988). The 'dyspneic-fear' model suggests that catastrophic cognitions follow fear and, therefore, that fear is a direct response to the sensation of respiratory distress (i.e., dyspnoea-fear). This hyperventilatory theory of panic posits that patients with COPD misinterpret the severity of their dyspnoea and that their fear of breathlessness

leads to a heightened state of psychological arousal. One of the criticisms of the 'dyspneic-fear' model is that it is specific to those patients who experience what Ley (1992) labels Type I/classic or hyperventilatory panic attacks and not to those experiencing anticipatory panic attacks (Type II), or cognitive panic attacks (Type III). Carr et al. (1992) examined the application of the 'dyspneic-fear' model in patients with asthma and PD and found that the model applies to patients with asthma (and no PD), but not to those individuals with only PD. The authors recommend that the cognitive model of panic is a better explanation of panic than the 'dyspneic-fear' model for patients with PD. Porzelius et al. (1992), and more recently Livermore et al. (2012), offer support for the cognitive model of panic by suggesting that ratings of catastrophic cognitions, but not dyspnoea, differentiate panickers from nonpanickers among patients with COPD. Furthermore, findings suggesting that actual respiratory function and perceived breathlessness do not affect levels of anxiety lend weight to the argument that elevated anxiety is a result of negative cognitions and symptom perception, rather than actual or perceived respiratory distress (Vögele & von Leupoldt, 2008).

The exact mechanism/link between respiratory impairment, hyperinflation and anxiety is unclear. It is possible that the rapid breathing response of a panic attack in patients with obstructive lung disease may also elevate (precipitate) dyspnoea through hyperventilatory mechanisms. As respiratory rate increases due to anxiety or increased respiratory demand (e.g., during exercise or an AECOPD), expiratory airflow obstruction causes an insufficient ability to exhale. This imbalance between inhalation and exhalation may lead to air trapping and

hyperinflation of the lungs, an increased work of breathing and a sense of greater effort to breathe. This may contribute to increased respiratory distress and dyspnoea, which further feeds the dyspnoea-anxiety cycle. In addition, the sensation of an unsatisfying (insufficient) breath and the discomfort caused by hyperinflation can directly cause anxiety in patients who experience hyperventilation in the context of obstructive lung disease (Neuman et al., 2006). The deleterious effect of anxiety and severe shortness of breath in COPD patients may discourage them from performing daily activities and engage in social interaction in fear of triggering further anxiety and embarrassment.

Yohannes (2008) and NICE (2010) assert that the chronic and progressive nature of COPD may lead to increased anxiety. For example, patients with COPD may endure frequent AECOPD and hospitalisations that can be a source of stress and anxiety for both patients and their families. In addition to the physiological and psychological associations between anxiety and COPD, there also appears to be a link between anxiety and COPD medications. For example, common medications such as albuterol, salmeterol, oral corticosteroids and theophylline can cause anxiety, especially among patients with long-term usage (Cantor & Jacobson, 2003; Shanmugam et al., 2007). Common medications used in the management of COPD may have anxiogenic properties and also stimulate sympathetic responses. For example, commonly prescribed medications such as  $\beta$ -agonists can mimic the actions of sympathetic adrenergic stimulation acting through  $\beta$ -adrenoceptors. This explains the common side-effects of  $\beta$ -agonists which include increased heart rate, palpitations and sweating (Katon et al. 2004).

### *2.4.1 SUMMARY*

The interactions between anxiety and COPD are far from clear. There is a limited but growing evidence base to indicate that a physiological pathway exists between dyspnoea and anxiety, or that COPD-related medications may elevate anxiety levels. Other theories focus upon the catastrophic misinterpretation of symptoms and the link between dyspnoea and fear. In all cases, current empirical evidence supporting these theories remains limited and unpersuasive. However, it is generally accepted that the aetiology of anxiety in patients with COPD is multifaceted and complex.

## **2.5 RISK FACTORS FOR ANXIETY IN PATIENTS WITH COPD**

Few studies have explored the risk factors for anxiety among patients with COPD. Due to a lack of long-term epidemiological studies that specifically seek to establish risk-factors, it is difficult to gain a detailed understanding of the most important risks for developing anxiety. However, several cross-sectional studies have explored the characteristics of patients with COPD who experience anxiety and have attempted to identify the most likely risk-factors.

The greatest focus of existing research has been upon the possible link between COPD severity and anxiety risk. In a study exploring the characteristics of COPD patients, Wagena and colleagues (2005) found no significant difference in psychological distress between patients according to their COPD severity

(based on GOLD categorisation). This finding has been supported by other studies exploring the relationships between anxiety and disease severity based on lung function (Engström et al., 1996; Gudmundsson et al., 2006). In contrast, Downson et al., (2001) found that patients with impaired lung function were at greater risk of developing anxiety. Also, Felker and colleagues (2010) found patients with very severe COPD were at more than three times the risk of having a clinical anxiety or depressive disorder (Felker et al., 2010). Studies exploring the subjective experience of COPD severity suggest that patients with worse perceived symptoms of COPD are at higher risk of anxiety (Cleland et al., 2007).

There is clearer evidence that sex may impact upon the risk of experiencing anxiety. Several studies have found that women with COPD are at greater risk of experiencing psychological distress, including anxiety than their male counterparts (Di Marco et al., 2006; Gudmundsson et al., 2006; Laurin et al., 2007). This is consistent with the elevated risk of anxiety among elderly women living in the community (Schoevers et al., 2003). Gudmundsson and colleagues found that in a multi-centre sample of 416 patients, 47% of women had clinically significant levels of anxiety (HADS-A total score  $\geq 8$ ), compared to 34% of men ( $p=0.009$ ). It is not clear why there is a higher prevalence of anxiety among women, although it has been suggested that women may be more susceptible to the negative effects of COPD upon health status (Antonelli-Incalzi et al., 2003).

Age may also be a contributing factor to the risk of developing anxiety. Cleland et al. (2007) found that anxiety (HADS-A total score  $\geq 11$ ) was more prevalent in patients who were younger than 60 years old, irrespective of COPD severity. The authors postulate that increased susceptibility to anxiety in younger COPD patients may be because they cope less well with the enforced lifestyle changes that are associated with COPD (Cleland et al., 2007). In contrast to these findings, a large study by Gudmundsson and colleagues (2006) found no association between anxiety and age in patients with COPD.

Smoking history and current smoking status also appear to be relevant. Gudmundsson et al., (2006) found that patients who currently smoked had a higher prevalence of anxiety than non-smokers (54% vs. 37%,  $p < 0.01$ ). Smoking is the most significant risk factor for developing COPD and high levels of anxiety have been identified as an important risk factor for adolescents starting to smoke (Patton et al., 1996; GOLD et al., 2011). It is likely, therefore, that those patients who develop COPD as a result of smoking have higher levels of anxiety when they begin to smoke (Hill et al., 2008). In addition, smoking is increased in patients with anxiety, so anxiety may be considered to be an aetiological factor in COPD (Lasser et al., 2000).

Other factors that are thought to elevate the risk of anxiety in patients with COPD include those patients who have low satisfaction in their marital relationships, patients who demonstrate poor disease coping strategies, and patients with low levels of social support (Ashmore et al., 2005; McCathie et al., 2002).

### *2.5.1 SUMMARY*

Although a number of potential factors have been identified that may increase the risk of anxiety in patients with COPD, the evidence remains ambiguous. The most consistent finding is that females and individuals who smoke may have an elevated risk of anxiety. The role of factors such as COPD severity and age are less clear. Further epidemiological studies that explore the long-term natural history of COPD and anxiety are needed to clarify the most important risk factors.

## **2.6 IMPACT OF CO-MORBID ANXIETY IN PATIENTS WITH COPD**

Psychological distress may reduce an individual's ability to cope with the physical symptoms of disease, which in turn may lead to further debility and worsening of psychological distress (van Ede, 1999). It is evident that the presence of co-morbid anxiety has a multifaceted impact upon patients with COPD. The following section will explore both subjective and objective outcomes associated with untreated co-morbid anxiety in patients with COPD.

Several studies have found that co-morbid anxiety has a negative influence upon HRQoL (Cully et al., 2006; Giardino et al., 2010). Giardino and colleagues (2010) conducted a large multicentre study on 1828 patients with emphysema and found that anxiety was inversely associated with HRQoL as measured by the St George's Respiratory Questionnaire (SGRQ; Jones et al., 1991). According



to Cully et al. (2006), the impact of anxiety on HRQoL can be extensive, affecting outcomes such as physical functioning, general health, pain, and disease-specific outcomes, such as mastery of illness and symptoms of dyspnoea.

It also appears that anxiety may have a deleterious role on the physical functioning of patients with COPD. Eisner et al. (2010) found that patients with anxiety ( $\geq 9$  on the HADS-A) had worse submaximal exercise performance on the 6-minute walk test and a greater risk of self-reported functional limitations. Likewise, Kim and colleagues (2000) conducted regression modelling to explore the role of anxiety in functional impairment and found that anxiety, as identified on the BAI, had a significant negative impact on functional ability reported on the Short Form-36 Health Survey (SF-36; Ware & Sherbourne, 1992).

Two large, long-term follow-up studies by Xu et al. (2008) and Gudmundsson et al. (2005, 2006) have explored the impact of anxiety in patients with COPD on healthcare utilisation, specifically the role of exacerbations and related hospitalisations. Xu et al. followed 491 patients with COPD for 1 year and found that patients with a score of  $\geq 11$  on the HADS-A experienced exacerbations that lasted almost twice as long as those without anxiety (adjusted incidence rate ratios, IRR: 1.92; 95% CI; 1.04-3.54). However, those patients with clinically significant symptoms of anxiety did not have longer hospital stays.

Gudmundsson and colleagues (2005, 2006) also followed a large group of patients ( $n=416$ ) over a 1-year period and found that patients with low health status (SGRQ score  $>60$ ) and higher anxiety (measured with the HADS-A) had an increased risk of rehospitalisation (hazard ratio, HR: 1.76; 95% CI, 1.16-

2.68). Likewise, Yohannes et al. (2000a) retrospectively found that the presence of an anxiety disorder was a major factor related to the frequency of COPD-related hospitalisations.

Other studies have found that the risk of exacerbations is also increased in patients with COPD and anxiety. For example, Eisner et al. (2010) found that patients with COPD and anxiety ( $\geq 9$  on the HADS-A) had a higher longitudinal risk of AECOPD (HR: 1.39; 95% CI, 1.01-1.90). However, Laurin et al. (2011) asserts that although the presence of anxiety may infer an increased risk of exacerbation in patients with COPD, there is little evidence to indicate that these exacerbations lead directly to hospitalisations. Rather, the exacerbations reported are usually symptom-based rather than event-based (i.e., ending in a hospitalisation). This is supported to some extent by an earlier study by Laurin and colleagues (2009) that followed patients with COPD for 2 years. Their results indicate that patients with a psychiatric diagnosis, as identified with a structured clinical interview, had a significantly higher rate of exacerbations treated in an outpatient setting, but no difference in the rate of exacerbations treated in inpatient settings.

It is not clear why patients with COPD and co-morbid anxiety may be at a greater risk of exacerbations and related healthcare utilisation. COPD patients with anxiety often have lower self-efficacy, functional limitations and poor health behaviours that may lead to inadequate disease-management and place them at a higher risk of exacerbations (Burgess et al., 2005; Kunik et al., 2005;

Laurin et al., 2009). However, the interactions underpinning this relationship are far from clear and require further investigation.

There have been few qualitative studies exploring the experience of living with COPD, and none that have specifically focussed upon the subjective experience of anxiety. However, there is some evidence to suggest that alongside the negative impact on measurable health outcomes, co-morbid anxiety also has a significant emotional impact. One qualitative study found that patients with COPD and symptoms of anxiety experience feelings of intense fear and vulnerability, especially at night (Shackell et al., 2007). It has also been suggested that because of the inextricable link between dyspnoea and anxiety, that patients with COPD experience repeated “shadow-of-death” moments – periods of extreme panic with thoughts associated with death (Bailey, 2001).

### *2.6.1 SUMMARY*

Although research exploring the impact of co-morbid anxiety in patients with COPD is still evolving, there is growing evidence to suggest that the impact is multifaceted. Anxiety appears to impact negatively upon HRQoL, as well as functional activities and exercise performance. The impact on healthcare utilisation is less clear, but it is evident that although anxiety may or may not lead to an increase in hospitalisations, it does increase the likelihood of symptom-based exacerbations and also increases the duration of hospitalisations and risk of readmission. Finally, although there is a paucity of

research exploring the subjective experiences of anxiety in patients with COPD, there may be a significant and lasting emotional impact.

## 2.7 MANAGEMENT OF ANXIETY IN PATIENTS WITH COPD

Despite the high prevalence of anxiety disorders in patients with COPD, recent reports indicate that only 31% of patients with clinical anxiety or depression are receiving treatment (Kunik et al., 2005). Although there is a growing research base exploring the management of co-morbid anxiety in patients with COPD, recent reviews have identified that the current state of evidence remains insufficient to support treatment guidelines (Cafarella et al., 2012; Usmani et al., 2011). Management approaches are focussed upon treatment strategies that cover three broad areas: pharmacological approaches, pulmonary rehabilitation, and psychological interventions. The following section will explore these three approaches and the corresponding evidence base relating to their efficacy in patients with COPD.

### 2.7.1 PHARMACOLOGICAL INTERVENTIONS

Pharmacological interventions are regularly used in the treatment of a variety of anxiety disorders including PD and GAD (Cafarella et al., 2012) and are recommended as the first-line approach to treating anxiety in patients with COPD (NICE, 2010). However, there is a dearth of high quality research supporting the pharmacological management of anxiety in COPD. For example, a recent Cochrane review exploring pharmacological treatments for anxiety

specifically in patients with COPD found only four studies (n=40) exploring the efficacy of selective serotonin reuptake inhibitors (SSRIs), tricyclic antidepressants (TZAs) and azapirones (Usmani et al., 2011). Due to poor study quality (e.g., small sample size and short follow-up periods), meta-analyses have not been undertaken (Usmani et al., 2011).

The most persuasive evidence supports the use of SSRIs for managing anxiety. Studies exploring the efficacy of SSRIs for treating anxiety have found small but non-significant reductions in anxiety symptoms (e.g., Eiser et al., 2005). However, sample sizes lack statistical power (n=28) and therefore these results have limited application. Despite unconvincing evidence supporting its efficacy, pharmacotherapy appears to be as commonly used to treat anxiety in patients with COPD, as in other chronic disease groups (Cafarella et al., 2012).

### *2.7.2 PULMONARY REHABILITATION*

The benefits of pulmonary rehabilitation (PR) in patients with COPD have been widely documented and include improvements in HRQoL, exercise tolerance, fatigue and dyspnoea (see Lacasse et al., 2007 for an extensive review). There is also growing evidence to support the role of PR in reducing symptoms of anxiety (Coventry & Hind, 2007). A recent systematic review and meta-analysis indicates that PR, incorporating exercise, education and social support, leads to a significant reduction in anxiety in patients with COPD (Coventry & Hind, 2007). Findings from three studies comparing PR to standard care found a standard mean difference (SMD) in anxiety symptoms of -0.33 (95% CI: -0.57 to

-0.09,  $p=0.008$ ) in favour of PR (Emery et al., 1998; Griffiths et al., 2000; Güell et al., 2006).

PR programmes usually involve a combination of goal setting, exercise training, education and psychosocial support (Nici et al., 2006). Although the various components may all have an important role both individually, or in combination, the multifaceted nature of PR makes it unclear which aspects of the PR programme have the greatest impact upon anxiety.

Exercise may facilitate the release of endogenous opiates and may also have a desensitising effect on anxiety symptoms such as dyspnoea and hyperventilation (Emery et al., 2008; Yohannes et al., 2010). Exercise-induced dyspnoea can be readily confused with anxiety-induced dyspnoea, so exercise allows patients to experience these symptoms in safety, often under the supervision of the rehabilitation coordinator such as a physiotherapist or exercise practitioner. This helps patients to learn to distinguish between physical and emotional symptoms and become desensitised to dyspnoea (Emery et al., 2008). A second proposed mechanism is that exercise causes increased temperature in specific brain regions, such as the brain stem, which may result in feelings of relaxation (Raglin & Morgan, 1981). Finally, findings from patients with chronic heart failure suggest that exercise may lead to additional psychosocial benefits, such as increased social support and quality of life (Wielenga et al., 1998).

Güell et al. (2006) found a significant reduction in anxiety in COPD patients who underwent a PR programme with a considerable exercise component, alongside breathing training techniques and disease education. However, few studies have specifically examined the role of exercise in the PR programme. A single, outdated study by Cockcroft et al. (1982) found that patients who underwent a controlled exercise programme demonstrated 'psychological improvement' that was non-significant.

The role of the educational component of PR in ameliorating anxiety has been examined in even less detail. Educational components usually involve symptom management (such as lung clearance techniques), information about medications, disease education, and advice on relaxation techniques (Nici et al., 2006). In their systematic review of the efficacy of PR, Coventry and Hind (2007) conclude that it is unlikely that an education component alone can reduce anxiety. However, education remains an important and complementary aspect of the PR programme which may help patients to understand the benefits of PR and to improve self-efficacy (Yohannes et al., 2010). Kunik and colleagues (2008) found that a COPD education intervention resulted in similar reductions in anxiety symptoms as a cognitive behavioural therapy (CBT) intervention. The authors postulate that anxiety may be reduced through the social interaction and support that occurs during educational sessions (Kunik et al., 2008).

### *2.7.3 PSYCHOLOGICAL INTERVENTIONS*

NICE guidelines advocate the role of psychological interventions for patients with diagnosed anxiety (NICE, 2011). The content of psychological intervention can vary from low-intensity interventions such as individual non-facilitated or guided self-help and psycho-educational groups, to high-intensity interventions such as CBT or applied relaxation (NICE, 2011).

A recent systematic review examining the efficacy of CBT in managing anxiety in patients with COPD found only limited evidence supporting this approach (Coventry & Gellatly, 2008). The authors conclude that there is some limited evidence that CBT, when combined with exercise and education reduces anxiety in patients with COPD (Coventry & Gellatly, 2008). A lack of consistency in the use of anxiety scales (e.g., HADS, STAI, SCL-90) and the use of small sample sizes ensure that it is difficult to conduct robust and sufficiently powered reviews of this management approach.

Since the publication of Coventry and Gellatly's systematic review in 2008, two randomised controlled trials have been conducted that explore the efficacy of CBT in patients with COPD (Hyninnen et al., 2010; Kunik et al., 2008). Kunik and colleagues (2008) compared an intervention of group CBT, consisting of eight 1-hour sessions, with a control intervention of eight 1-hour COPD education sessions in sample of 238 predominantly male (96%) patients with stable COPD. Both interventions led to a clinically significant reduction in anxiety as measured on the BAI. More recently, Hyninnen et al. (2010) conducted a



randomised controlled trial (n=51) comparing a 7-week intervention of 2 hours/week of CBT to a control group who received enhanced normal care (consisting of a 5-10 minute telephone call with a clinician every two weeks). A significant reduction in anxiety score (mean change of 4.8 on the BAI) was reported in the CBT group post-treatment, which remained at 6-months follow-up. No change in anxiety was reported in the control group who received enhanced normal care.

A recent systematic review and meta-analysis explored psychologically based interventions in patients with COPD, including individual and group CBT, psychotherapy, stress management and progressive muscle relaxation (Baraniak & Sheffield, 2011). The authors analysed eight studies and found a small but significant combined reduction in anxiety ( $r = -0.27$ ; CI: -0.42 to -0.14) when compared to standard treatment groups that included interventions such as PR or COPD education (Baraniak & Sheffield, 2011). However, when studies that included non-treatment controls were pooled and analysed, no significant reduction in anxiety was found.

#### *2.7.4 SUMMARY*

There remains a paucity of evidence on which to base recommendations for one type of management intervention. Although pharmacological interventions are recommended for managing patients with GAD and PD and are endorsed as a first line treatment approach in patients with COPD (Cafarella et al., 2012; NICE, 2010), there is evidence to suggest that patients with COPD are often reluctant

to take additional medication (Yohannes et al., 2001). In addition, caution should be taken when prescribing medicines such as tricyclic antidepressants, mirtazapine and benzodiazepines as there is an increased risk of respiratory centre depression and associated respiratory failure (Cafarella et al., 2012). This indicates that a non-pharmacological approach to management is perhaps most appropriate for patients with COPD. However, although there is some emerging evidence in favour of non-pharmacological approaches such as PR and CBT, further research is needed to explore the effects of these interventions on large cohorts with minimal dropout rates.

## 2.8 DETECTION OF ANXIETY IN PATIENTS WITH COPD

GOLD (2011) and NICE (2010) guidelines recommend that all newly diagnosed COPD patients should undergo a detailed medical assessment, including the assessment of anxiety symptoms. The NICE (2010) guidelines for COPD also indicate that clinicians should be alert to the presence of anxiety in their patients. However, these COPD-specific guidelines fail to recommend clear strategies for identifying anxiety in this patient group. Although NICE (2011) guidelines on the management of GAD and PD (with and without agoraphobia) recommend that a formal diagnosis of anxiety should be undertaken using a structured clinical interview, this is not always practical. Therefore, it is recommended that COPD patients seen in clinical settings are screened using self-report screening tools (Maurer et al., 2008). In clinical settings a two-step approach is often incorporated in which patients are first screened using brief, inexpensive scales. Those patients who screen positive for anxiety usually

undergo a more thorough assessment to confirm diagnosis with a clinical interview (Vodermaier & Millman, 2011).

There are a number of barriers to the detection of anxiety in patients with COPD. These typically fall into patient- or clinician-level barriers. Patient-level barriers to anxiety detection include the stigma associated with mental illness which may lead patients with anxiety to exaggerate somatic complaints instead of acknowledging emotional problems, the reluctance to disclose anxiety symptoms, and the confusion or masking that may occur in physical symptoms. Clinician-level barriers include the lack of a standardised assessment approach for patients with COPD, the lack of a disease-specific screening tool, the poor utilisation and uptake of existing screening tools, lack of confidence, skills and knowledge of anxiety symptoms and disorders, and the stigma of mental illness (Kunik et al., 2005; Maurer et al., 2008; Yohannes et al., 2010).

Such barriers may help to explain why in one recent study exploring the prevalence of anxiety disorders in patients with COPD, less than a third (29%) of patients with a clinical anxiety disorder had received a physician's diagnosis (Kunik et al., 2005).

In clinical practice and research settings, monitoring of anxiety symptoms and screening of anxiety disorders is typically undertaken using self-report anxiety scales. The following section focuses specifically on these scales and critically discusses their use in patients with COPD.

### 2.8.1 EXTANT ANXIETY SCALES

A number of different scales have been utilised for the measurement and screening of anxiety symptoms and disorders in patients with COPD. Within this section, I critically review six scales that have been either recommended by clinical guidelines for COPD, are widely utilised in COPD-related research, and/or are validated for use in patients with COPD (see Table 2.7). A summary of the scales' psychometric properties is provided, with a focus on reliability and validity. Also, where appropriate, recommended cut-off values will be discussed in order to assess the clinical utility of these scales to screen for anxiety disorders.

**Table 2.7: Comparison of reviewed anxiety scales**

<b>Scale</b>	<b>Number of items</b>	<b>Administered by (duration)</b>	<b>Application</b>	<b>Partially validated in COPD</b>	<b>Recommended by</b>
BAI	21	Self or interviewer (5 min)	Outcome measure & screener	Yes	ACCP
DASS	42	Interviewer (10 min)	Outcome measure	No	ACCP
GAI	20	Self or interviewer (5-10 min)	Outcome measure & screener	Yes	-
HADS	14	Self (2-5 min)	Outcome measure & screener	Yes	GOLD, ACCP
STAI	40	Self (10 min)	Outcome measure & screener	No	-
TMAS	28/50	Self (10-15 min)	Research	No	-

COPD, Chronic Obstructive Pulmonary Disease; BAI, Beck Anxiety Inventory; ACCP, American College of Chest Physicians; DASS, Depression Anxiety Stress Scales; GAI, Geriatric Anxiety Inventory; HADS, Hospital Anxiety and Depression Scale; GOLD, Global initiative for chronic Obstructive Lung Disease; STAI, State-Trait Anxiety Inventory; TMAS, Taylor Manifest Anxiety Scale.

### **2.8.1.1 Beck Anxiety Inventory (BAI)**

Beck and colleague's (1988) inventory is a self-report instrument that was specifically designed to minimize confounding symptoms with depression and avoid the nonspecific dimension of negative affect. The scale contains 21 items, with 14 items reflecting somatic symptoms of anxiety and panic. The BAI is recommended by the ACCP as a viable screening tool for use in COPD patients (Maurer et al., 2008). A few studies have utilised the BAI in COPD-related research (e.g., Kim et al., 2000; Kunik et al., 2008), yet the scale remains one of the most common instruments for measuring anxiety in general medical research (Piotrowski, 1999).

Items are presented as a list of symptoms with respondents asked to rate on a four-point scale how much they have been bothered by each symptom in the preceding week. Scores range from 0-63. Beck and Steer's (1990) manual suggests that a cut-off point of  $\leq 9$  indicates normal levels of anxiety; 10-18 mild-moderate levels of anxiety; 19-29 moderate-severe levels of anxiety, and 30-63 severe levels of anxiety.

The reliability of the BAI appears to be very high. A review by McDowell (2006) found 16 studies reporting Cronbach's  $\alpha$  for internal consistency of 0.86 to 0.94 across a range of populations, including elderly medical outpatients, psychiatric patients and healthy populations. Test-retest reliability for the BAI is reported to be 0.73 for one-week and 0.67 for 11 days (Fydrich et al., 1992).

The factor structure of the BAI has been explored by Hewitt and Norton (1993) and Creamer et al. (1995) with both studies finding a two factor solution: one factor of cognitive symptoms and a second factor representing somatic symptoms. McDowell (2006) reviewed studies reporting on the convergent validity of the BAI and found correlation coefficients of 0.44-0.68 with the STAI and 0.47-0.67 with the Hamilton Anxiety Rating scale for Anxiety. Steer et al. (1994) explored whether the BAI could distinguish between elderly medical patients (without psychiatric disease) and psychiatric outpatients to establish if the high number of somatic symptoms in the BAI may lead to false-positives. Although the BAI performed generally well in discriminating between groups, the authors note that six of the somatic items did not distinguish between medical patients and psychiatric patients.

Although Beck and co-workers (1988) claim that the BAI can be used both as a screening tool for anxiety disorders and as an outcome measure for anxiety symptoms, others contend that the BAI is not a marker of anxiety in general but rather a marker of symptoms of panic (Cox et al., 1996). The BAI appears to have good face validity for symptoms of PAs, querying 10 of the 14 symptoms listed in DSM-IV-TR classification (APA, 2000). However, it has limited face validity for detecting GAD, as it does not include worry-type symptoms that are integral to a DSM-IV-TR diagnosis (Leentjens et al., 2008). This assertion is supported by a recent FA, which suggests that the strongest quality of the BAI is to assess panic symptomology (Leyfer et al., 2006). Leyfer and colleagues (2006) conclude that whilst the BAI has achieved significant discriminant validity for detecting patients with PD, it has sacrificed construct validity for

assessing overall anxiety. This is probably because Beck and co-workers (1988) deliberately excluded items which may overlap with depression, particularly symptoms associated with GAD (e.g., restlessness, irritability or fatigue). Cox and colleagues (1996) argue that the BAI is compromised as a tool for identifying general anxiety and should be considered a marker of panic.

#### **2.8.1.2 Depression Anxiety Stress Scale (DASS)**

The DASS (Lovibond & Lovibond, 1995) was designed to test for emotional disturbance as part of a broad clinical assessment and contains three subscales relating to depression, anxiety and stress. The scale contains 42 negatively worded statements (14 for each subscale) and has a four-point response format, which ranges from “*did not apply to me at all*” (0) to “*applied to me very much, or most of the time*” (3), with a high score indicating worse distress. The anxiety subscale contains four smaller sections relating to autonomic arousal (5 items), skeletal musculature effects (2 items), situational anxiety (3 items), and subjective experience of anxious affect (4 items). A 21-item version of the scale is also available (Lovibond & Lovibond, 1995).

The DASS has not been validated in patients with COPD, yet the AACCP (Maurer, 2008) recommend the scale for use in this clinical population. A search of the literature on PubMed identifies a single study (Moore & Zebb, 1998), which has utilised the DASS in patients with COPD.

Although the DASS was not designed to screen for specific DSM or ICD diagnoses, the authors suggest that based on percentiles derived from a normative sample of students, scores of 0-77 represent normal states, 78-86 represent mild disorder, 87-94 represent moderate disorders, 95-97 represent severe disorders, and 98-100 represent extremely severe distress (Lovibond & Lovibond, 1995). Nieuwenhuijsen and colleagues (2003) report an optimal cut-off score of five on the anxiety subscale for detecting clinical anxiety disorders.

A review exploring the reliability of the DASS has found that  $\alpha$  internal consistency coefficients for the anxiety subscale are generally very high, ranging from  $\alpha=0.84-0.92$  (McDowell, 2006). In addition, two-week test-retest correlations were 0.79 for a mixed sample of outpatients (Brown, 1997). However, a recent Rasch analysis of the 21-item DASS in patients with chronic back pain indicates that although the depression subscale performs strongly (demonstrating good model fit), the anxiety and stress scales are not internally consistent enough to be used for individual anxiety assessment and are only suitable for assessing groups of patients (Parkitny et al., 2012). Previous Rasch analyses have also found poor model fit for the DASS anxiety subscale and recommend removal of items to achieve model fit (Shea et al., 2009).

The validity of the DASS has been investigated by several studies whose findings support the three-factor structure originally proposed by the scale's developers (e.g., Brown et al., 1997; Nieuwenhuijsen et al., 2003). However, there is some evidence of cross-loadings or poor fit on the anxiety subscale. For example, one study found that item 9 *"I found myself in situations that made me*



*so anxious I was most relieved when they ended*” loaded moderately on both the anxiety and stress factors (Brown et al., 1997). Similarly, items 30 *“I feared that I would be ‘thrown’ by some trivial but unfamiliar task,”* and 25 *“I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat)”* have been found to load equally onto both anxiety and stress factors (Brown et al., 1997; Nieuwenhuijsen et al., 2003). Finally, item 19 *“I perspired noticeably (e.g., hands sweaty) in the absence of high temperatures or physical exertion”* appears to load primarily onto the stress factor (Nieuwenhuijsen et al., 2003). Studies exploring the concurrent validity of the DASS demonstrate high correlations with the BAI (0.83) but low correlations with the STAI (0.44) (Antony et al., 1998; Brown et al., 1997).

The DASS focuses on discriminating between anxiety and depression rather than providing comprehensive coverage of these constructs. Therefore, it omits several common symptoms of anxiety and depression that may be useful in case detection e.g., sleeping difficulties, tiredness and irritability. According to McDowell (2006), the omission of non-specific items from the DASS may have increased specificity at the expense of sensitivity. However, Nieuwenhuijsen et al. (2003) found that an optimal cut-off score of 5 resulted in a high sensitivity (0.92) but a poor specificity (0.40), thus leading to a high percentage of false positives. The DASS may be a valuable tool in initial screening due to its high sensitivity for detecting clinical disorders, but further investigations are needed to confirm the presence or absence of a clinical disorder for those who screen positive. According to Nieuwenhuijsen and colleagues (2003), for every 100

patients that are screened using the DASS, 66 will screen positive for an anxiety disorder, yet only 19 will actually prove to have a disorder.

#### **2.8.1.3 Geriatric Anxiety Inventory (GAI)**

The GAI (Pachana et al., 2007) is a recently developed scale which was designed specifically for use in older populations. It was designed to minimise fatigue by being brief, minimise symptom overlap of medical conditions by excluding somatic items, and utilises a dichotomous scoring format for ease of use in patients with mild cognitive impairment. The GAI is a 20-item scale consisting of statements with an agree/disagree response format. Respondents are asked to reflect on the previous week when answering the items.

Although the GAI has only recently been developed, there are some early data relating to the scale's reliability and validity. Pachana and colleagues (2007) report a Cronbach's  $\alpha$  for internal consistency to be 0.91 and 1-week test-retest reliability of 0.91 in a geriatric psychiatric sample. Other studies exploring the psychometric properties of the GAI in patients with Parkinson's disease have found a Kuder-Richardson coefficient of 0.95 (Matheson et al., 2012), whilst Cheung and colleagues (2012) report a Cronbach's  $\alpha$  of 0.92 in patients with COPD.

Pachana et al. (2007) demonstrated that the GAI correlated significantly with a number of extant scales including the BAI and STAI. The optimal cut-off score for identifying patients with an anxiety disorder was found to be 8/9, which

correctly classified 78% of patients with a sensitivity of 73% and a specificity of 80%. However, a study exploring the sensitivity and specificity of the GAI in detecting anxiety disorders in older patients with COPD has recently been undertaken that found a significantly lower cut-off score of 2/3. This correctly identified 80% of the sample with a sensitivity of 86% and a specificity of 78% (Cheung et al., 2012).

Although Pachana and co-workers (2007) claim the original GAI is unidimensional in nature, they present no empirical data to support this assertion. In response, a study exploring the psychometric properties of the Spanish version of the GAI found three factors: cognitive symptoms, arousal-related symptoms, and, perhaps surprisingly considering the conceptual model of the scale, a factor containing somatic symptoms (Márquez-González et al., 2012). Four of the items of the GAI loaded predominantly onto the somatic factor indicating that the GAI may indeed have a confounding somatic element. Item 7 *"I often feel like I have butterflies in my stomach"*, item 12 *"I get an upset stomach due to my worrying"*, and item 18 *"I sometimes feel a great knot in my stomach"*, all had factor loadings of  $>0.7$  which suggests that these stomach-related items do not fit the non-somatic model of anxiety originally proposed by Pachana and co-workers (2007).

#### **2.8.1.4 Hospital Anxiety and Depression Scale (HADS)**

The HADS (Zigmond & Snaith, 1983) was designed as a self-assessment scale for detecting clinically significant anxiety and depression in outpatients. It is widely

used in general medical settings and is the most frequently utilised scale in the COPD literature. A recent review exploring the prevalence of anxiety symptoms in patients with COPD found nine studies that utilised the HADS-A as a screening tool (Yohannes et al., 2010). The HADS-A has also been mentioned by the ACCP (Maurer et al., 2008) and GOLD (2011) for screening anxiety in COPD populations.

The HADS contains 14 items covering both anxiety and depression, with patients asked to recall their experiences during the past week. The anxiety component of the HADS (the HADS-A) contains seven items: three items referring to fear or panic and four items referring to generalised anxiety. Scores range from 0-21 for the anxiety subscale. A major innovation in the development of the HADS was the deliberate exclusion of symptoms that might arise from the somatic aspects of illness. This ensured that the scale (in theory) is not be confounded by physical symptoms of illness or disease (Martin et al., 2005).

Zigmond and Snaith (1983) originally proposed a cut-off score of  $\geq 8$  as a possible case of anxiety, and  $\geq 11$  for a definitive case. More recently, Bjelland and colleagues (2002) and Bunevicious et al. (2007) report that a score of  $\geq 9$  represents the optimal cut-off point for clinically significant symptoms of anxiety. However, Bunevicious et al. (2007) also found that the optimal cut-off points varied depending on the type of anxiety disorder being screened. For example, the optimal cut-off point for patients with PD was  $\geq 11$  yet the score was  $\geq 9$  for phobias and GAD. Other studies have demonstrated that optimal cut-

off points in older patients with COPD may be considerably lower, perhaps as low as  $\geq 4$  (Cheung et al., 2012).

The internal consistency of the HADS is generally moderate-high with reported Cronbach's  $\alpha$  for the anxiety subscale of 0.76-0.93 in patients with chronic disease (Bjelland et al., 2002). Quintana et al. (2003) demonstrated a Cronbach's  $\alpha$  of 0.86 for both the anxiety and depression subscales. Test-retest reliability has been reported as 0.84 at two weeks, 0.73 at two to six weeks, and 0.70 at  $>6$  weeks (Herrmann, 1997).

The validity of the HADS has been extensively tested. In terms of factorial validity, the majority of studies have found a two-factor structure for the scale, corresponding to "anxiety" and "depression" (Bjelland et al., 2002; Quintana et al., 2003). However, other studies have found a three-factor solution indicative of the tripartite model of anxiety and depression (Clark & Watson, 1991; Dunbar et al., 2000).

Although there is consistent support of the HADS for the purposes of clinical screening of anxiety disorders and assessment of the severity of anxiety symptoms, there is growing concern regarding the scale's validity and reliability in populations with illness and disease (Martin, 2005). In particular, Martin highlights that if the bi-dimensionality of the HADS is not supported, or found to be compromised in certain clinical populations, then the scale cannot be concluded to reliably and accurately measure the two domains of anxiety and depression. A review of the HADS by Bjelland et al. (2002) supported the use of

the HADS in a range of settings (including primary care, acute care and psychiatric populations), yet only 11 of the 20 studies they review support a bi-dimensional factor structure. A more recent review that focussed on studies from the year 2000 onwards found that only seven of 22 studies report a bi-dimensional structure (Martin, 2005). The majority of contemporary studies report a 3-factor structure, yet one study by Karimova and Martin (2003) found that in a sample of pregnant women (n=100) there were 4-5 factors underlying the HADS. In addition, even among those studies who report a bi-dimensional structure, there were a number of instances where items loaded onto the 'wrong' factor (Martin, 2005).

Quintana et al. (2003) explored the psychometric properties of the Spanish version of the HADS on a large sample of patients (n=685) that included patients with diseases such as COPD, asthma and Crohn's disease. FA revealed that across the entire sample, anxiety and depression items loaded well onto the corresponding anxiety and depression factors. However, among the COPD sample, there was evidence of cross-loadings between factors. Item 2 on the HADS-A *"I get a sort of frightened feeling as if something awful is about to happen"* loaded more onto the depression factor than the anxiety factor. In addition, item 5 on the HADS-Depression (HADS-D) *"I have lost interest in my appearance"* loaded evenly onto both the anxiety (0.46) and depression (0.48) factors. Other studies exploring the factor structure of the HADS-A suggest that item 4 *"I can sit at ease and feel relaxed"* is particularly prone to cross-loading. For example, studies in patients with musculoskeletal disease and cancer have found item 4 loaded considerably higher on the depression factor than the

anxiety factor for which it was designed (Boermeester & Berard, 1998; Pallant & Bailey, 2005).

Researchers have also questioned whether the HADS represents the two factors of “anxiety” and “depression” that was conceptualised by the scale’s designers. For example, Johnston et al. (2000) explored the factor structure of the HADS in patients with somatic disease such as myocardial infarction and stroke and found a 2-factor solution that they label “psychological” and “somatic”. Although the majority of the items loaded primarily onto the “psychological” factor, item 4 on the anxiety subscale demonstrated a split loading between “psychological” (0.42) and “somatic” (0.37). Two items on the depression subscale also showed split loadings (item 1 *“I still enjoy the things I used to enjoy”* and item 6 *“I look forward with enjoyment to things”*). The authors suggest that item 4 on the HADS-A, as well as a poorly performing item on the HADS-D; item 4 *“I feel as though I am slowed down”*, are both items that are likely to be influenced by patients’ physical conditions. This may question the non-somatic nature of the HADS.

There is also growing evidence that the structure of the HADS-A may not be unidimensional in patients with chronic disease. Studies utilising Rasch analyses of the HADS-A in patients with COPD and cancer have found some misfit to the unidimensional model. Tang and colleagues (2008) demonstrated that item 7 *“I get sudden feelings of panic”* was a mute item on the Chinese version of the HADS-A among a sample of patients with COPD. Additionally, the study found that items 2 and 6 *“I feel restless as if I have to be on the on the*

*move*” were of borderline misfit. A Rasch analysis by Smith et al. (2006) in a sample of cancer patients found additional evidence that item 6 did not fit the unidimensional model.

Martin (2005) concludes that due to improvements in FA techniques, notably the increased use of confirmatory factor analysis (CFA), the majority of contemporary studies exploring the factor structure of the HADS support a tri-dimensional structure. This three-factor structure supports the ‘tripartite’ model of anxiety and depression proposed by Clark and Watson (1991) that includes ‘negative affect’, ‘autonomic anxiety’, and ‘anhedonic depression’. When the tripartite model is applied to the HADS, it is suggested that the seven anxiety items are split between negative affectivity (four items) and autonomic anxiety (three items). Dunbar et al. (2000) conducted CFA on the HADS and found that items 2 *“I get a sort of frightened feeling as if something awful is about to happen”*, 5 *“I get a sort of frightened feeling like butterflies in the stomach”*, and 7 *“I get sudden feelings of panic”* loaded onto the autonomic anxiety factor (see Figure 2.4). Martin (2005) argues that the autonomic anxiety component of the HADS-A would be sensitive to the somatic aspects of experience, which accompany illness and disease. Therefore, there may be considerable source of contamination in the scale due to physical symptoms that can negatively influence the accuracy of case detection.



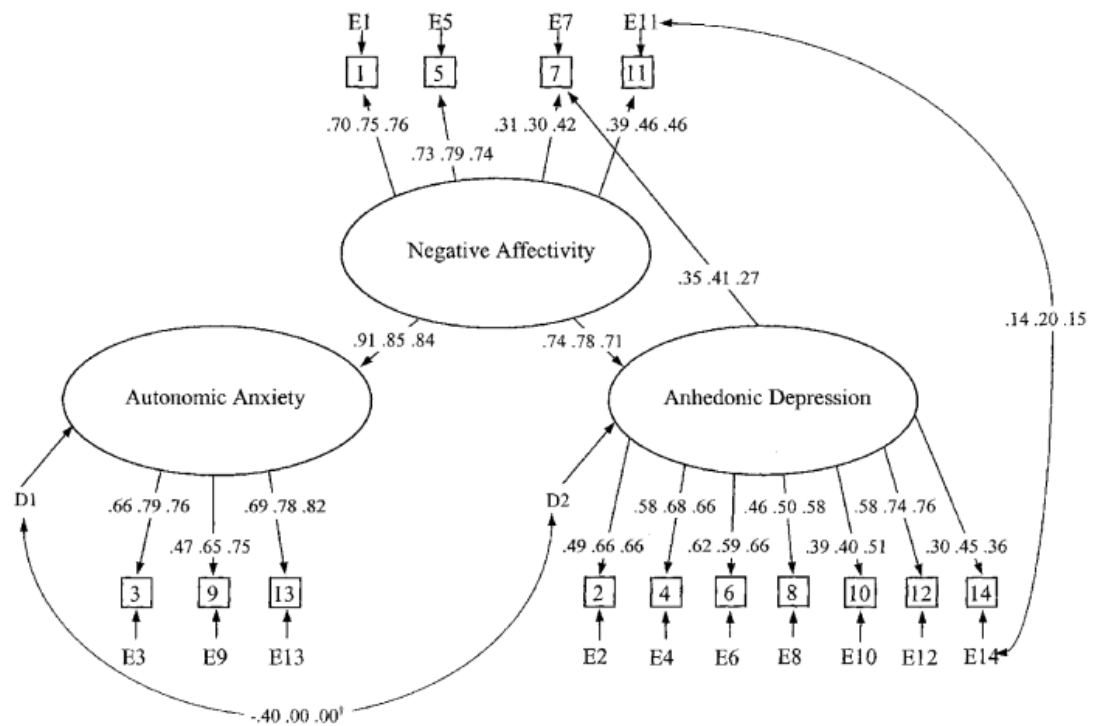


Figure 2.4: Hierarchical factor structure of the HADS based on the 'tripartate' model (Reproduced with permission from Dunbar et al., 2000)

### 2.8.1.5 State Trait Anxiety Inventory (STAI)

The STAI (Spielberger et al., 1983) is a 40-item scale measuring transient and enduring levels of anxiety. The first 20 items assess situational or state anxiety with respondents asked to indicate *"How you feel right now, that is, at this moment."* The second 20 items refer to underlying or trait anxiety for which respondents are asked to indicate *"How you generally feel."* The time frame for the state questions is *"right now"*, which may yield problems when assessing patients with PD outside the context of a PA (Leentjens et al., 2008). Each item on the STAI is scored on a four-point scale and totals for the trait and state subscale range from 20-80.

The STAI is used frequently within the COPD research, both as an outcome measure (e.g., Paz-Diaz et al., 2007) and as a screening tool (e.g., Kvaal et al., 2001). It is also the most commonly used anxiety scale in contemporary medical research (Piotrowski, 1999). Reliability for the scale is generally good. McDowell (2006) reviewed a number of studies exploring the internal consistency of the STAI, the majority of which were in healthy student populations, and found Cronbach's  $\alpha$  of between 0.83 and 0.95 for the state scale and 0.67 and 0.95 for the trait scale. Predictably, test-retest scores for the state scale are lower than those for the trait scale. For example, McDowell (2006) reports 30-day retest values ranging between 0.71-0.75 for the trait scale and 0.34-0.62 for the state scale.

To assess the validity of the scale, Vagg and colleagues (1980) conducted a factor analytic study of the STAI and found a four-factor structure that distinguished between state and trait anxiety and between positively and negatively worded items. However, a Rasch analysis in the mid-1980s showed that a number of items on both the state and the trait scales did not meet the scaling criteria and that there was inadequate coverage at the low end of the anxiety continuum (Tenenbaum et al., 1985). More recently, it has been suggested that the STAI is not specific to anxiety. Rather, McDowell (2006) suggests that the STAI correlates more highly with depression scales than with anxiety scales such as the BAI.

Results from a FA conducted by Bieling et al. (1998) suggest that the trait part of the STAI does not assess 'pure' anxiety, but rather includes items that reflect

depression and general negative affect. The authors found a hierarchical factor structure with a principal factor representing negative affect and two secondary factors reflecting anxiety (items representing rumination, worry and disturbing thoughts) and depression (items representing dysphoric mood and negative self-appraisal). A more recent FA found poor fit for the two-factor model and instead proposed a five-factor model: a 10-item anxiety factor containing three related sub-factors (restlessness, self-confidence and worry), a four-item unsuccessfulness factor and a six-item happiness factor (Caci et al., 2003).

Kvaal and colleagues (2005) assessed the state subscale of the STAI in screening for anxiety disorders among stable geriatric patients. Their results suggest that the optimal cut-off score is 54/55, with a sensitivity of 0.82 and a specificity of 0.88.

The STAI contains a high number of items for a self-report scale. However, Leentjens and colleagues (2008) argue that some of the symptoms of anxiety disorders such as GAD, PD and phobias, such as fatigue, concentration and irritability, are not represented in the state scale, limiting the face and content validity of the STAI as a generic marker of anxiety.

#### **2.8.1.6 Taylor Manifest Anxiety Scale (TMAS)**

The TMAS is a little used scale that was originally designed for selecting patients for inclusion in psychological experiments. It has subsequently been used to assess anxiety as a general personality trait and not for assessing

anxiety as a clinical entity. This limits the use of the TMAS as a clinical screening tool or research outcome tool. However, one group of researchers exploring exercise tolerance and oxygen therapy in patients with COPD have utilised Taylor's (1953) scale as a marker of anxiety status (Borak et al., 1991; 1996; 1998).

The TMAS exists as 50-item or 28-item versions and consists of statements with a true and false scoring system. Scores range from 0-50 or 0-28 depending on the version used. Reliability estimates based on Kuder-Richardson coefficients were 0.78 and 0.84 in Iranian college students (Hojat & Shapurian, 1986). Taylor's (1953) original paper reported test-retest correlations of 0.89 over a 3-week period, 0.82 over five months and 0.81 over 9-17 months. In terms of validity, the TMAS does not correlate well with other assessments of anxiety (Siegman, 1956). Factor analyses have also found inconsistent results. For example, one study of graduate students by Livneh and Redding (1986) found 18 factors with eigenvalues above one, whilst another study reported a five-factor solution (Moore et al., 1984).

### *2.8.2 COMMENTARY ON EXTANT SCALES*

Whilst all of the scales discussed above appear to offer generally high reliability and validity, there are a number of issues which may limit their practicality in screening and assessing markers of anxiety in clinical populations, especially those with chronic somatic disease such as COPD. In the following section, the

limitations of extant scales in these populations are summarised, with a particular focus upon their use in patients with COPD.

#### **2.8.2.1 Somatic focus**

Although some extant scales have been designed specifically to omit somatic anxiety symptoms, it is evident that none have so far achieved this goal. Both the HADS and the GAI were based on a cognitive model of panic, yet results from CFAs reveal that each scale contains items that load onto somatic factors. Scales such as the BAI, DASS, STAI and TMAS include somatic items in varying proportions. The BAI is heavily weighted towards somatic markers of anxiety and contains 14 somatic items out of a total of 21.

The fact that extant anxiety scales assess somatic markers of anxiety is not a problem in the majority of settings. On the contrary, somatic symptoms are key considerations for the diagnosis of a range of anxiety disorders. For example, GAD is characterised by fatigue and muscle tension, whilst PD is characterised by PAs that are dominated by somatic symptoms including palpitations, breathlessness and sweating (APA, 2000). However, these anxiety symptoms mirror the common symptoms experienced by patients with COPD and may confound the diagnosis of anxiety. According to Hill et al. (2008), anxiety scales that contain somatic items such as breathlessness and fatigue are likely to overestimate the prevalence of anxiety (i.e., create false positives), since some symptoms may be associated with the primary respiratory component. Coffman (2002) adds that further confusion can be caused by the side effects of

medications. For example, bronchodilators used by patients with COPD can cause tremor, palpitations and insomnia, which can be associated with symptoms of anxiety. Without a formal psychiatric interview, it is difficult to establish the cause of somatic symptoms and therefore scales containing somatic items may have a limited clinical utility in this population.

#### **2.8.2.2 Coverage of anxiety symptoms**

In an effort to distinguish between anxiety and depression, both the BAI and the DASS focus upon symptoms which are specific to anxiety. The DASS omits items relating to shared symptoms of anxiety and depression such as fatigue, tension and irritability. Likewise, to discriminate between the two types of psychiatric disorders, the BAI focuses upon psychophysiological symptoms of anxiety which can help to distinguish between anxiety and depression. The scale focuses upon symptoms of hyperarousal such as inability to relax, heart palpitations and tremor. Subsequently, those patients with high levels of cognitive anxiety may be underrated, whilst those exhibiting high levels of somatic symptoms may be overrated (McDowell, 2006).

The strong correlations between both the DASS and BAI and depression scales means that it is likely that there is a common underlying negative factor.

Therefore, it is impossible to separate anxiety and depression completely (McDowell, 2006). It is possible, however, that efforts to discriminate between anxiety and depression have resulted in scales that do not cover the full range of anxiety symptoms. For example, Cox et al. (1996) argue that the somatic-

dominated BAI represents somatically laden panic rather than more general (cognitive) symptoms of anxiety. It is posited that both the DASS and the BAI assess markers of the majority of anxiety disorders with the exception of GAD (McDowell, 2006).

Scales such as the HADS appear to cover a more general range of symptoms, including items relating to fatigue and irritability, but this can lead to cross-loading between anxiety and depression factors. Factor analysis of the HADS demonstrates that there is a general negative affect factor underlying the scale and this, in theory, may limit the specificity of the HADS for detecting and discriminating between anxiety disorders and depression.

### **2.8.2.3 Factor structure and loadings**

There appear to be many inconsistencies relating to factor structures of extant scales, which place doubts on the construct validity of these instruments. FA is often used to test the theoretical basis of the scale in an attempt to see if the scale measures what it purports to measure (DeVellis, 2003). FA of the HADS, GAI, STAI and TMAS all reveal contrasting factor structures to those intended by the authors. This places serious doubts on whether the scales really are assessing markers of anxiety in the way that they were conceptualised.

Studies exploring the BAI and the DASS have demonstrated a consistent factor structure, but these scales appear to be prone to cross loadings between factors, thus questioning their construct validity. For example, both the BAI and DASS

appear to contain items that are designed to assess anxiety, yet load predominantly onto a depression factor. This also seems to be the case for the HADS. Specifically, cross loadings between anxiety and depression factors appear to be particularly evident among patients with COPD (Quintana et al., 2003).

#### **2.8.2.4 Validation in patients with COPD**

Perhaps the most important limitation to the clinical utility of existing anxiety scales is that few have been validated in patients with COPD. This is an especially important consideration as scales may perform very differently between clinical populations and identical item/scale performance cannot be assumed between groups (DeVellis, 2003). For example, the majority of extant anxiety scales were developed for general use e.g., HADS for use in medical outpatients.

Of the six scales that have been recommended for use, or are frequently used in patients with COPD, only the BAI, GAI and the HADS have been validated (in a limited fashion) in this patient group (Cheung et al., 2012; Kunik et al., 2005; 2007). However, no studies have specifically sought to explore the reliability or validity of these anxiety scales in patients with COPD. Cheung and colleagues (2012) and Kunik et al., (2005; 2007) have explored the ability of the GAI, HADS and BAI to screen for the anxiety disorders in patients with COPD.



Although the HADS is recommended by NICE and AACP guidelines and is likely to be the most commonly used scale among clinicians and researchers working with patients with COPD, Cheung and colleagues (2012) suggest that there is sufficient doubt in its ability to screen anxiety disorders accurately in older populations (particularly those with COPD) for it not to be recommended for clinical or research purposes.

#### **2.8.2.5 Summary**

It is clear that although all of the scales reviewed have promising reliability and validity in general medical populations, or in the populations they were designed for, few, with the exception of the BAI, GAI and HADS have been partially validated in patients with COPD. The ability of these three scales to screen for clinical anxiety in patients with COPD demonstrates that none have particularly high sensitivity. In addition to the lack of validation in patients with COPD, all of the scales reviewed have limitations in one or more key areas, including the inclusion of somatic items, selective symptom coverage and questionable factorial validity.

The purpose of a screening tool is to identify those patients who are in need of further psychiatric examination. Identifying high numbers of false positives is costly, both financially, and in terms of wasted time for the clinician and the patient. A scale that can efficiently screen patients for anxiety is characterised by a high sensitivity, which ensures that all individuals with an anxiety disorder are identified (Lalkhen & McCluskey, 2008).

## 2.9 SUMMARY OF CHAPTER 2

In addition to defining anxiety in both a medical and psychological context, this chapter has reviewed the prevalence, aetiology, pathophysiology, impact, risk factors, management and detection of anxiety in patients with COPD.

It is evident that co-morbid anxiety in patients with COPD remains poorly understood. Yet, clinical anxiety disorders, particularly GAD and PD are highly prevalent in patients with COPD and occur at a greater rate than among age-matched healthy populations and patients with other chronic disease. Although there are a number of competing theories that attempt to explain the elevated prevalence of anxiety in this patient group, there is likely to be a multifactorial and potentially, a bidirectional relationship. Patients who are female and who continue to smoke appear to have an elevated risk of anxiety. The impact of unmanaged co-morbid anxiety in patients with COPD is multifaceted and includes reduced HRQoL, exercise tolerance and ability to perform activities of daily living (ADL). There is also some evidence to suggest that untreated co-morbid anxiety increases healthcare utilisation in patients with COPD.

Although there is little evidence to support a single management approach, there is emerging evidence that non-pharmacological treatments such as PR and psychological interventions can be efficacious in reducing symptoms of anxiety in patients with COPD. However, the lack of a standardised assessment tool, along with the poor quality of existing clinical trials limit the extrapolation of these findings to the wider COPD population.

This chapter also reviewed those scales that are recommended for clinical use, or have been used in COPD-related research. Although six extant scales were reviewed, there are limitations to the application of these scales for use in patients with COPD. In particular, extant scales are limited by potentially confounding somatic items, partial symptom coverage, unclear factor structure and lack of validation in this patient group.

The absence of a validated tool and the questionable suitability of existing tools for assessing and screening anxiety in patients with COPD suggests that a new tool that is specifically designed for this purpose has considerable clinical utility. Although anxiety may be recognised through cognitive-language markers, motor-behavioural markers and physiological markers, this thesis focuses on both cognitive-language and motor-behavioural markers. One reason for omitting reference to physiological markers of anxiety is that these markers are often confused or attributed to other underlying medical conditions in primary care settings (Gelenberg, 2000). A focus on cognitive or behavioural symptoms enables a more accurate diagnosis in patients who have complex medical conditions which are typified by somatic symptoms.

## Chapter 3 : SELF-REPORT RATINGS SCALES AND CONSIDERATIONS IN SCALE DEVELOPMENT

*“There are two possible outcomes: if the result confirms the hypothesis, then you’ve made a measurement. If the result is contrary to the hypothesis, then you’ve made a discovery.”*

Enrico Fermi

### 3.1 INTRODUCTION

In Chapter 2, the relationship between co-morbid anxiety and COPD was reviewed. It is evident that co-morbid anxiety has a significant impact upon patients, yet it remains under recognised and undertreated. In terms of detecting anxiety in patients with COPD, clinical guidelines advocate the role of reliable and valid self-report ratings scales. This chapter will explore self-report psychiatric ratings scales and their clinical use. Following this, key factors in the development of self-report scales are explored in detail, including considerations in item content and scale structure, concepts of reliability and validity, and the scale development process.

### 3.2 SELF-REPORT RATINGS SCALES IN PSYCHIATRY

Scientific progress depends upon accurate measurement and instruments used in clinical and research settings must be both reliable and unambiguous in what they claim to measure (Keedwell & Snaith, 1996). Yet, it is only during the past 60 or so years, that measurement has become a routine part of healthcare research and practice (Blais & Baer, 2010). Measurement of psychiatric disorders involves an understanding of both signs and symptoms as markers of the disorder. Signs may be considered to be objective findings that are observed by the clinician, such as restlessness, whereas symptoms are subjective experiences that are reported by the patient e.g., feeling nervous (Kessler et al., 2000). Self-report rating scales are designed to be instruments that quantify patients' subjective experiences and aid the clinician in identifying, quantifying and tracking changes in these important but not directly observable markers (Blais & Baer, 2010).

Self-report scales typically fall into two groups: screening scales, and symptom-rating scales. Screening scales are designed to identify the presence or absence of a specific disorder, such as a personality disorder, and provide a dichotomous outcome (i.e., case or non-case). In comparison, symptom-rating scales are designed to quantify the severity of symptoms. This may involve assessing the severity of symptoms in a pre-diagnosed disorder, or monitoring of sub-clinical symptoms (Blais & Baer, 2010). Although rating scales quantify symptom severity, many also report cut-off scores that can be used to indicate possible clinical disorders in a dichotomous fashion.

Self-report scales have become increasingly popular since the 1940s due to a growing need for reliable and valid outcome measures for both research and clinical practice. In addition, Kessler et al. (2000) suggest that there are a number of important practical benefits to self-report scales. First, they are relatively inexpensive to develop and distribute. Second, the continuous measurement approach is better suited to the understanding of diverse symptoms than a dichotomous clinician judgement. Third, the psychometric properties of self-report scales are easier to record than clinician judgement.

Self-report scales fulfil, if developed appropriately, many of the criteria that are required from an outcome measure. For example, a survey of Canadian clinicians found high levels of agreement that outcome measures used in clinical practice should have the following characteristics: brevity, simplicity, ease of scoring, reliability, validity and sensitivity to change (Bellamy et al., 1998).

Although self-report scales have a number of strengths that make them suitable for both clinical and research settings, there are a number of factors which influence their effectiveness and application. These fall under two main categories: response distortions and psychometric properties. Response distortions refer to response styles (such as acquiescence bias, extreme and central tendency responding) and response sets (such as social desirable responding), whereas psychometric properties refer principally to reliability and validity. These factors will be discussed in detail in sections 3.4 'Reliability and validity' and 3.5 'Processes in scale development'.

### 3.3 SCALE DEVELOPMENT THEORY

#### 3.3.1 INTRODUCTION

The following section explores the two distinct approaches to scale development that are utilised by researchers: classical test theory (CTT) and item response theory (IRT). Within this section, a brief overview of each approach is given. The strengths and limitations of these two competing theories are then discussed and a justification of the theory that guides this thesis is provided.

#### 3.3.2 CLASSICAL TEST THEORY

Throughout the 20<sup>th</sup> Century, scale development was dominated by the classical measurement model, also known as CTT (Novick, 1966; Spearman, 1904). CTT assumes that items within a scale are comparable indicators of an underlying construct or latent variable, that is, not directly observable and not constant (DeVellis, 2003). The latent variable is the cause of how a person will respond to an item. For example, a measurement of depression may consist of multiple items such as “*I feel sad*” or “*My life is joyless*”, which relate to the latent variable of depression. An individual’s response to these items is largely determined by how they are feeling at that time (DeVellis, 2003).

According to CTT, a participant's response to each item on a scale (the observed score) is thought to consist of both a "true" score and some random error. In a perfectly reliable scale, where all error has been removed, the true score is equal to the observed score. The more error there is in a scale, the worse the reliability will be (Redding et al., 2006). Figure 3.1 demonstrates the path diagram for the relationship between the variables according to classical theory. In the diagram, D is the latent variable "depression", X<sub>1</sub> through X<sub>4</sub> stands for the items in the scale, and e<sub>1</sub> through e<sub>4</sub> stand for measurement errors for each item.

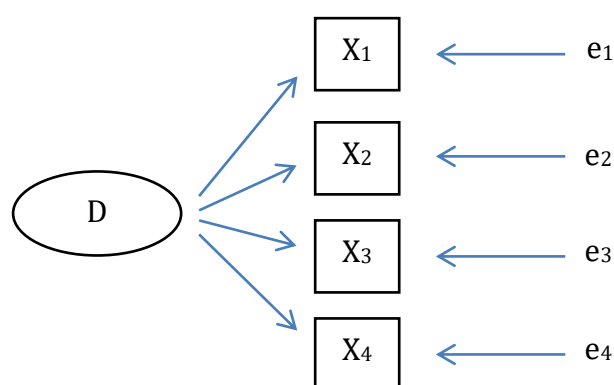


Figure 3.1: Path diagram illustrating relationships between variables according to Classical Test Theory (CTT)

### 3.3.3 ITEM RESPONSE THEORY

Although CTT has served the scale development and measurement community for the most of the last century, IRT has seen an exponential growth in recent decades (Fan, 1998). IRT comprises a set of generalised linear models and



statistical tests that connect observed responses to a respondent's location on an unmeasured underlying "latent" trait (Hays et al., 2000). IRT, as the name implies, focuses on the theory of the item, rather than test-level focus of CTT. IRT is also known as modern test theory, and although the roots of IRT can be traced back to Louis Thurstone's work in the 1920s (Thurstone, 1925), it did not become widely used until the 1980s when access to personal computers allowed psychometricians to conduct the complex mathematical modelling required.

In IRT, each item's relationship to the latent variable is assessed and reliability is not enhanced by redundancy (as in CTT), but by identifying better items. Whereas items in CTT are designed to be very similar to each other and to tap into the underlying variable in the same way, items in IRT are designed to tap different degrees or levels of the attribute (DeVellis, 2003).

IRT assumes that a scale is unidimensional and, therefore, that only a single latent trait is influencing item responses. The correspondence between the predicted response (i.e., probability of success) to an item and the latent trait is known as an item-characteristic curve that takes an S-shape (see Figure 3.2).

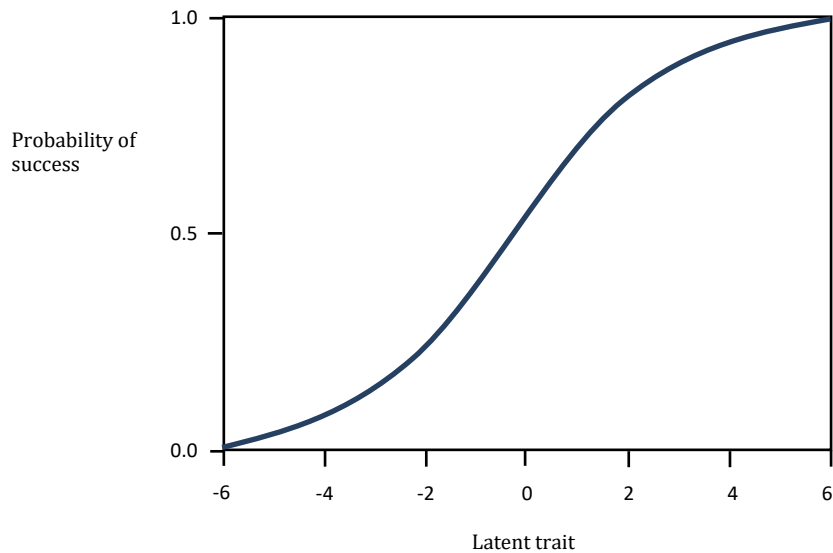


Figure 3.2: Item characteristic curve showing the relationship between the location on the latent trait and the probability of answering the item correctly

#### *3.3.4 STRENGTHS AND LIMITATIONS OF CLASSICAL TEST THEORY AND ITEM RESPONSE THEORY*

IRT was developed to resolve some of the limitations of CTT. One of the most important limitations of CTT is that norms used for interpretation of the test scores are sample specific. In contrast, IRT is sample independent. Another limitation of CTT is that in order to examine an item's performance, it is necessary for a respondent to complete all items on a scale. In contrast, IRT techniques model the relationship between the latent trait and each individual item (Reid et al., 2007).

The theoretical advantages of IRT mean that it is increasingly becoming accepted as the preferred approach for scale development. However, there are a number of small, but practically relevant limitations of IRT. The first limitation

is that IRT requires large sample sizes. Hambleton and Jones (1993) recommend that samples of at least 500 respondents are needed to conduct IRT. In comparison, CTT can be applied to much smaller samples, perhaps a few hundred respondents or fewer. This makes CTT especially useful when there are limitations in time and recruitment. CTT also has advantages over IRT in that the simplicity of the model and its assumptions make CTT an attractive alternative to the complex and expensive software required for IRT (Fan et al., 1998; Hambleton & Jones, 1993). CTT trades complexity for simplicity, whereas IRT focusses upon the precision of items within a scale (DeVellis, 2003)

Although there is increasing acceptance of IRT for scale construction, developers in clinical settings continue to adopt CTT approaches. According to DeVellis (2003) the two approaches are comparable in many situations, especially if the aim is to produce a scale with non-hierarchical items. In CTT, the assumption is that each item is a roughly equal parallel indicator of the underlying latent variable. This assumption fits well when measuring characteristics such as attitudes, beliefs and mood states, particularly when utilising Likert-type scaling. In contrast, IRT is a more suitable for measuring hierarchical responses in which non-consistent measurement such as Guttman or Thurstone scaling is used. In these cases, each item represents a specific level of the attribute being measured (DeVellis, 2003).

### *3.3.5 CHOICE OF THEORY UNDERPINNING THE CURRENT RESEARCH*

The current research follows tradition and adopts a CTT approach to scale development. This decision was guided primarily by issues relating to sample size. The author and supervisory team agreed that it was unlikely that this research project would be able to recruit >500 respondents, particularly those from a clinical setting. In addition, the availability of statistical software at the University meant that CTT would be a more viable approach.

There is empirical evidence to suggest that although IRT might be theoretically more robust, CTT and IRT may yield similar outcomes. For example, Fan et al. (1998) conducted an empirical comparison of CTT and IRT and found that the results between approaches were comparable. In particular, the degree of invariance of item statistic across samples, usually considered to be theoretically superior in IRT, also appeared to be comparable.

## **3.4 RELIABILITY AND VALIDITY**

### *3.4.1 INTRODUCTION*

In order to be useful for both research and clinical application, a scale must be both reliable and valid (DeVellis, 2003). Reliability minimises random error whilst validity minimises systematic error. In order to be valid, a score must have adequate reliability, yet a reliable score does not necessarily have to be valid. Thus, reliability is usually established prior to validity (Corcoran & Fisher,

2000). The following section discusses these two important psychometric properties in the context of scale development.

### 3.4.2 RELIABILITY

Reliability is a fundamental issue in psychological measurement and is concerned with random error in measurement (McDowell, 2006). Scale reliability or internal consistency may be defined as the proportion of variance attributable to the true score of the latent variable (DeVellis, 2003). Internal consistency is a measure of to what extent items in a scale are correlated with each other and therefore that items are all measuring (i.e., are manifestations of) the same thing (DeVellis, 2003). Internal consistency is usually calculated with Cronbach's coefficient  $\alpha$  (Cronbach, 1951), a measure of the average inter-correlations within a scale. Cronbach's  $\alpha$  is defined as:

$$\alpha = \frac{n}{(n-1)} \left( 1 - \frac{\sum_{i=1}^n s_i^2}{s_{sum}^2} \right)$$

Where  $s_i^2$  are the estimates of the variances of the  $n$  items and  $s_{sum}^2$  is variance of the sum of all items. The calculated  $\alpha$  is a number between zero and one, with one representing an instrument with 'perfect' internal consistency (Streiner & Norman, 2003).

There is no absolute answer regarding what level of  $\alpha$  is adequate as the purpose of the measurement influences the standard of measurement required (McDowell, 2006). For example, a scale used in a clinical setting to make important health decisions requires higher internal consistency than a scale measuring multifaceted attitude constructs. According to Nunnally (1978),  $\alpha$  should be above 0.70 to indicate a high level of internal consistency. Streiner and Norman (2003) argue that an  $\alpha$  higher than 0.90 might indicate some redundancy of items but other psychometricians recommend that  $\alpha$  of 0.90 should be targeted, especially for scales designed for clinical use (Kline, 2000).

Other types of reliability should also be considered during scale development. Split-half reliability provides a second test of internal consistency and is achieved by randomly splitting the scale in half and calculating the correlation between the scores for each half of the scale (Kline, 2000). Split-half reliability is usually calculated using Guttman's split-half coefficient.

Temporal stability can also be computed by having the same sample of participants complete the same scale on more than one occasion. This measure of test-retest reliability enables the measurement of how constant scores remain from one occasion to another (DeVellis, 2003). The rationale underlying this approach to reliability is that if a measure truly reflects a meaningful construct, it should therefore assess the construct comparably on two separate occasions (DeVellis, 2003). Of course, the time interval between these two occasions will depend on the underlying construct being assessed and can vary

considerably. Streiner and Norman (2003) suggest that a time interval of between 2 and 14 days is usual for calculating temporal stability in psychological testing.

Test-retest reliability is commonly calculated using the Pearson or Spearman's rank correlation coefficient. However, as McDowell (2006) points out, this approach can seriously exaggerate the impression of reliability as it ignores many of the mismatches between scores by only measuring the relationships of the relative standings between the scores. Therefore, McDowell (2006) advises the use of the intraclass correlation coefficient (ICC) which measures the consistency of the subjects' actual scores on the two ratings.

Research by Bland and Altman in the 1980s highlighted that basic correlation coefficients were inappropriately being used to compare measurement tools in medical journals (Altman & Bland, 1983; Bland & Altman, 1986). They argued that rather than measure correlations, which are likely to be high in most tools that are designed to measure similar constructs, that differences between the measurements should be plotted against the mean scores. This can also be applied when comparing one measure over time (i.e., temporal stability) and allows the limits of agreement to be calculated. According to Bland and Altman (1986), a reliable scale should have 95% of the differences lying between SD of -2 and +2. Rankin and Stokes (1998) assessed the use of ICC and Bland and Altman tests and recommended that neither test alone provides sufficient information and, therefore, suggested that both tests should be used.

### 3.4.3 VALIDITY

Establishing a high level of reliability is an important step in scale development, but it is not sufficient on its own. Alongside reliability, the scale developer should also consider issues of validity. A scale “... *is said to be valid if it measures what it claims to measure*” (Kline, 2000; 17). This is an important consideration, as although a scale may have proven reliability (i.e., respondents get the same score each time they complete the scale), there needs to be additional evidence that the scale is measuring what we believe it measures.

Traditional approaches to defining validity have adopted a ‘trinitarian’ perspective which divides validity into ‘three Cs’: content validity, criterion validity, and construct validity (Landy, 1986). However, Landy (1986) argues that validation processes are not so much directed towards the integrity of tests (where the attributes of a test e.g., the three types of validity, are ticked off in a checklist fashion) as they are directed toward the inferences that can be made about the attributes of the people who have produced the test scores.

Establishing validity, therefore, can be seen as a process of hypothesis testing that is limited only by the imagination of the scale developer and their ability to develop experiments to test their hypotheses. This modern approach to validity testing provides a problem to the scale developer in that the wider social science community continue to grade validity based on the traditional ‘trinitarian’ approach. Therefore, the author will comply with convention and describe validity under the headings of content, criterion and construct validity.



### 3.4.2.1 Content validity

Content validity can be defined as “... *the extent to which a specific set of items reflects a content domain.*” ( DeVellis, 2003: 49). Kline (2000) and DeVellis (2003) argue that content validity is easiest to evaluate when the domain is well defined. This is more difficult to establish when a scale measures attitudes and beliefs as it is challenging to determine the range of potential items and whether the sample of items is representative (DeVellis, 2003). This process is subjective and typically involves asking experts to review items to establish content that might have been omitted but should be included.

Alvan Feinstein (1987) proposed an extension to content validity which he termed “sensitivity”. Sensitivity is an underlying principle in the area of clinimetrics and refers to the clinical appropriateness of a scale. This can be divided into five main topics, which can be assessed subjectively: the purpose of the scale (clinical function and justification), the overt format of the scale (comprehensibility, clarity), face validity (aimed at the right area), content validity (representative of the domain), and ease of usage (time and effort required to complete).

Perhaps the least persuasive yet still highly desired type of validity is face validity. That is, do the items appear on the surface to be measuring what they actually are? (Streiner & Norman, 2003). This is particularly important in self-report scales because, as Streiner and Norman (2003) state, “*If the item appears irrelevant, then the respondent may very well object to it or omit it, irrespective of*

*its possibly superb psychometric properties*" (pp.66). Although this appears to be similar to content validity in that this is essentially a subjective appraisal of general acceptability (Gregory, 2003), some experts advocate that scale developers consider face validity during the early stages of the scale development process (DeVellis, 2003; Streiner & Norman, 2003). According to Nevo (1985), face validity should be judged by the respondent and not by the scale developer. Whilst it is important that the scale appear valid, face validity alone is insufficient to demonstrate that the scale is measuring what it claims to measure.

#### **3.4.2.2 Criterion validity**

Criterion validity is concerned with demonstrating the accuracy of a scale. This can be established by demonstrating an empirical association between the scale and some other measure of the same construct, ideally, a 'gold standard' which has already been used and accepted in the field (Streiner & Norman, 2003).

There are two main forms of criterion validity: concurrent validity and predictive validity. In concurrent validity, the new scale is correlated with the criterion measure, which are both completed at the same time. In contrast, predictive validity assesses the ability of the new scale to predict future changes in relevant variables (Streiner & Norman, 2003).

Concurrent validity can be used to measure the degree of agreement between the two measures based on the correlation between their total scores. In addition, when a 'gold standard' produces a dichotomous outcome e.g., a

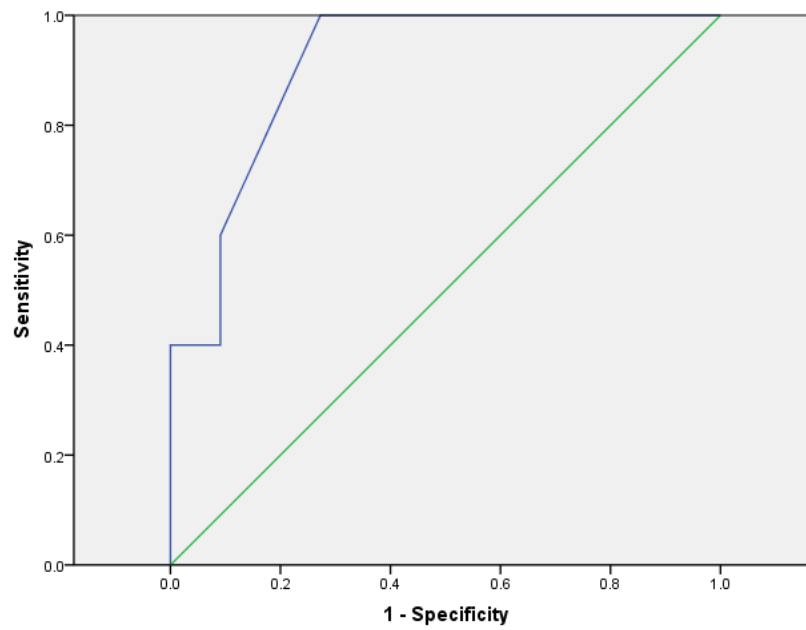
medical diagnosis, a threshold score can be calculated that demonstrates how well the new scale distinguishes between groups (i.e., those with a particular diagnosis and those without).

Two types of error can occur when calculating a threshold or cut-off score: the test may fail to identify patients who have the condition, or it may falsely classify people without the condition as having it. The term “sensitivity” refers to the proportion of the people with the condition (positives) who are correctly identified by the scale, while “specificity” refers to the proportion of people without the condition (negatives) who are correctly identified by the scale (McDowell, 2006). An increase in sensitivity is almost always accompanied by a decrease in specificity. Therefore, the aim of the scale developer is to calculate the score which provides the best balance between sensitivity and specificity. Given that cut-off scores affect the number of false positives and false negatives, the choice of score will have both clinical and economic consequences. A higher rate of false negatives leaves a number of patients unrecognized who are likely in need of support, whereas an elevated level of false positives may lead to an increase in unnecessary healthcare costs (Vodermaier & Millman, 2011).

A common approach to determining a cut-off score is to plot true-positives (sensitivity) against false-positive results (1-specificity) for each potential cut-off score in a scale forming a curve known as the receiver operating characteristic (ROC; McDowell, 2006; Streiner & Norman, 2003). The curve (see Figure 3.4a) illustrates the trade-off between sensitivity and specificity and the area under the curve (AUC) indicates the amount of information provided by

the test. An AUC of 0.5 (the diagonal line in Figure 3.4a) indicates that the test is no better than simply guessing whether a person has the condition or not. However, values above 0.5 indicate that the scale has merit as a screening tool. According to Swets (1988) values between 0.5-0.7 represent poor accuracy, values between 0.7-0.9 have some use as a diagnostic tool, and values of  $\geq 0.9$  indicates a highly accurate tool. A ROC curve can also be used to measure the diagnostic characteristics of several tools at once (see Figure 3.4b). In this example, the curve with the largest AUC (scale B, i.e., the curve closest to the top left of the graph) has the best diagnostic properties in terms of sensitivity and specificity.

a.



b.

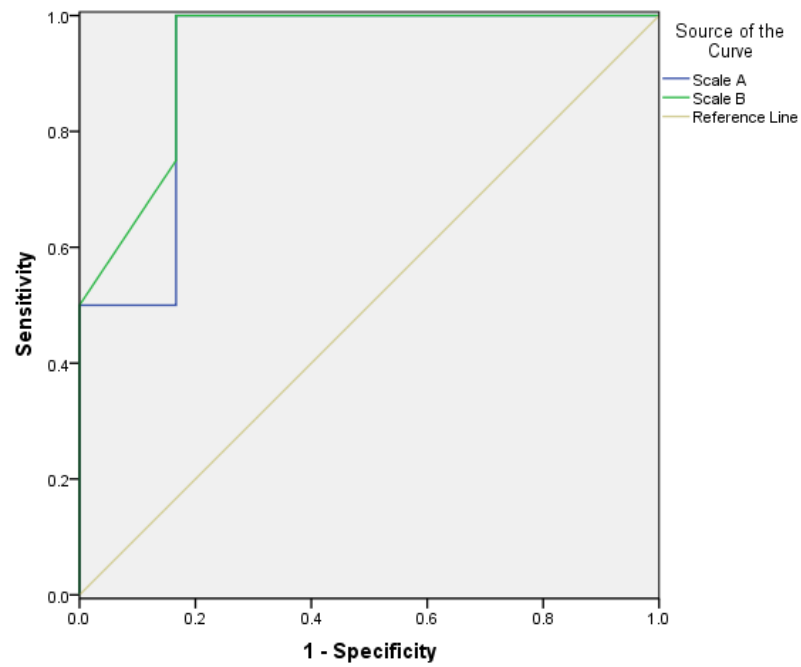


Figure 3.3: Example of ROC curve for a) a single scale, and b) comparison between two scales

### 3.4.2.3 Construct validity

Construct validity (Cronbach & Meehl, 1955) can be defined as “... *the extent to which a measure ‘behaves’ the way that construct it purports to measure should behave with regard to established measures of other constructs.*” ( DeVellis, 2003: 53). Establishing construct validity is an on-going process of empirically testing whether a measure behaves as it should according to theoretical assumptions. As Kline (1979: 11) asserts, in order to test construct validity, “...*a number of hypotheses are set up that would be tenable if the test were valid.*”

There is no single proof of construct validity, so a scale developer should systematically build an evidence base to support the adequacy of the scale (McDowell, 2006). This process typically involves testing multiple *a priori* hypotheses to support the behaviour of the scale based on the conceptual definition of the construct. Each supportive study serves only to strengthen what Cronbach and Meehl (1955) term the “nomological network”. According to Cronbach and Meehl (1955) this network includes the theoretical framework for what you are trying to measure, an empirical framework for how you are going to measure it and the specification of linkages found between the theoretical and empirical frameworks.

One hypothesis that may be tested is whether the scale correlates well with other scales that purport to measure similar constructs. This is known as “convergent validity”. Conversely, a second hypothesis may state that the scale will not correlate with other scales that measure unrelated phenomena, a process known as “divergent validity” or “definition by exclusion” (Kline, 2000).

McDowell (2006) argues that as this process is one of empirical hypothesis testing, the scale developer should always declare what level of correlation is adequate prior to testing.

Another method for establishing construct validity is to determine group differences, this is also known as “known-groups validation” (DeVellis, 2003). In this method, the scores of groups, who, according to the conceptual model are expected to perform differently, can be compared using statistical procedures. For example, a scale which purports to measure ADL could be tested on two groups (e.g., a healthy group vs. a group with chronic lower back pain). Significant differences in scores would disprove the null hypothesis that the scale fails to differentiate between them (McDowell, 2006).

Construct validity can also be tested by proving the ability of a scale to detect change that actually occurs (McDowell, 2006; Streiner & Norman, 2003). For example, scores on a scale measuring pain would be expected to change if a sample of patients are given pain medication. This element of construct validity is especially important in scales that are designed to be used in a clinical research setting as knowing the responsiveness of an instrument is valuable in calculating the power of a study and the sample size required.

Finally, construct validity may be established through the use of statistical analysis to determine whether there is an underlying conceptual structure of a scale. Confirmatory factor analytical procedures are usually undertaken to

define underlying scale structure. This is discussed in detail in the succeeding section ('Statistical tests for scale development').

#### *3.4.4 SUMMARY*

Reliability and validity are two important concepts in scale development.

Reliability may be defined in terms of internal consistency (i.e., internal reliability) and temporal stability (i.e., test-retest reliability). Validity is a more complex measure which can be established throughout the scale development process. In the early stages of scale development, content validity and face validity can be established. Criterion validity can be established by comparing a new scale against gold standard measures and exploring the screening properties of the scale. Finally, construct validity can be measured through empirically testing *a priori* hypotheses, including the scale's conceptual factor structure, know-groups validity and convergent validity.

### 3.5 PROCESSES IN SCALE DEVELOPMENT

#### *3.5.1 INTRODUCTION*

Within the following section, the processes of scale development are explored. This is principally focussed on the initial item development process, where decisions on item writing and scale format are made, and the subsequent item selection and validation process which involves quantitative approaches that are concerned with establishing reliability and validity of the scale.



### 3.5.2 ITEM DEVELOPMENT

The first phase of the scale development process can be separated into several sub-phases that have a shared objective of developing an internally consistent scale. Integral to this process is what Rowan and Wulff (2007: 461) describe as the “*predevelopment stage*” – defining the latent variable that is to be measured through a thorough review and understanding of existing literature (DeVellis, 2003; Redding et al., 2006).

Following this, a development phase can begin where a pool of scale items are developed. For many researchers, simply “borrowing” items from existing scales is adequate when developing item pools and generating new scales (Morizot et al., 2007; Yesavage & Brink, 1983). For example, Zhang and Yu (1998) developed a pool of items for their life satisfaction scale by selecting those that already existed in a previous scale. However, Comrey (1988) does not recommend this procedure as it requires that all the needed items in the right form be available in the pool. According to Comrey (1988), items must meet two criteria: a) they must have been written specifically to measure the same construct, and b) they must satisfy a statistical criterion of relatedness by correlating with each other sufficiently to define an item factor in a FA of items after they have been written. In order to achieve these criteria, it is usually necessary to develop some new items.

The development of a scale is dominated by quantitative data and analyses, however, an increasing number of scale developers have incorporated a qualitative phase of exploratory work in the scale development process (e.g., Jones et al., 2009b; Michalak et al., 2010; Okuyama et al., 2000; Ushiro, 2009). Qualitative inquiry can be especially useful to scale development researchers in that the validity of the quantitative research can be enhanced by first being grounded in real life situations through having interviews from an open perspective (Rowan and Wulff, 2007). Qualitative inquiry in the early stages of scale development may also *“serve as a vehicle for us to see if there may be some yet unexplored or untapped areas of the topic in questions (or new informants) that could yield specific new items”* (Rowan and Wulff, 2007: 451).

In writing the item pool, it is important to pilot as many items as possible, but this needs to be balanced with the demand that are placed upon the respondent. Kline (2000) recommends that twice the number of items that are anticipated in the final scale are included in the item pool. To minimise random error and enhance reliability, items need to be interpreted in a consistent manner, therefore, wording and clarity of items is important. Developers should avoid exceptionally lengthy items and consider reading difficulty level at which the items are written (DeVellis, 2003). A readability formula such as the Flesch Reading Ease Score (Flesch, 1948) which predicts the difficulty of text based on average word and sentence length and number of syllables can help to avoid confusing items. According to DeVellis (2003), a reading level between the fifth and seventh grades (equivalent to Year 6 in the UK i.e., age 10-11 years) is an appropriate target for instruments that will be used in the general population.

In addition, face validity and content validity can be enhanced at this stage by collaborating with experts in the field and with respondents who represent the population that the scale is being defined for.

Another key consideration is deciding upon response and scaling formats.

There have been a multitude of scaling methods using within health-related research including Thurstone, Guttman and visual analogue scaling (Streiner & Norman, 2003). However, by far the most common are Likert scales (Likert, 1952). Their popularity may be a result of the fact that they are relatively simple to construct, easily analysed and are familiar to most respondents (Kline, 2000). Likert scaling presents the respondent with a declarative statement, followed by response options that indicate varying levels of agreement or endorsement to an attitude or experience (DeVellis, 2003). An example of a Likert response format for an item is as follows:

**I am generally a happy person.**

*Strongly Agree   Moderately Agree   Moderately Disagree   Strongly Disagree*

There are a number of important decisions to be made regarding the number of response options and their wording, and these have received considerable debate within the literature (e.g., DeVellis, 2003; Kline, 2000). However, it is generally assumed that response options to be worded so as to have roughly equal intervals with respect to agreement or endorsement and that greater numbers of response options will improve scale reliability by increasing discrimination between individuals.

DeVellis (2003) recommends that validation items should be included at this stage to provide information about convergent and discriminant validity.

However, Worthington and Whittaker (2006) recommend that this is not done, in order to keep questionnaire length short and reduce the burden on respondents.

Considerations relating to the potential for response bias should also be considered at this stage of the scale development process. Two common biases of acquiescence bias and social desirability bias are suggested to reduce the validity of a scale. Acquiescence bias is the tendency to give a positive (or consistent) response to an item regardless of its content or the direction of the wording (Locker et al., 2007). Social desirability bias, on the other hand, is the unconscious tendency to give a socially acceptable response (Locker et al., 2007).

In order to minimise acquiescence bias, scale developers frequently include both positively and negatively worded items. The theory underlying this approach is that the change in item structure will result in the respondent giving more careful consideration to their response (Bowling, 2009). Although this strategy is a generally accepted practice, research exploring the construct validity of the Zung Self-rating Depression Scale (SDS; Zung, 1965) and the STAI challenges this convention (Schotte et al., 1996). These findings indicate that significant differences exist in mean scores between negatively and positively worded items, and that factor structures of the scales demonstrate negative and

positive factors. Strategies for predicting the extent of acquiescence bias and social desirability bias include using uncorrelated items to estimate response styles and estimating response styles from existing questionnaires (Chami-Castaldi et al., 2008).

Extreme and central tendency responding are also a potential issue in scale validity. Extreme responding refers to the tendency of the respondent to favour the endpoints or extreme categories of the scale response set disproportionately (Naemi et al., 2009). Rasch analyses indicate that approximately 30% of scale respondents are 'extreme responders' (Austin et al., 2006). Extreme responding is the opposite of central tendency responding in which respondents tend to favour the mid-point of the response set (Naemi et al., 2009). One strategy for reducing central tendency is to have a 'forced response' e.g., an even number of responses with no midpoint (DeVellis, 2003). This approach is useful in attitudinal scaling where there is often a clear neutral standpoint, but less so in self-report symptom scales in which the midpoint is usually a middle value of symptom severity. Strategies to reduce extreme responding are less clear. As extreme responses are more likely to occur in smaller response sets, one possibility is to increase the number of response options available to respondents. However, there is the danger that response sets can be too long, thus presenting the respondent with categories that are not meaningful (Chami-Castaldi et al., 2008).

Once an item pool has been developed, it should then be reviewed by a group of experts who are knowledgeable in the content area (DeVellis, 2003). This will

enhance content validity of the scale and ensure that items fully represent the defined construct. Expert opinion may also be sought on the wording and clarity of the items. However, as discussed previously, respondent input may be more valuable in assessing issues of face validity and therefore the scale developer may consider their input at this stage.

### *3.5.3 STATISTICAL TESTS FOR SCALE DEVELOPMENT*

After establishing a final pool of items, these can then be assessed statistically to establish which items are consistent with the latent variable and which items should be removed. In CTT, two types of statistical procedures are involved: Item analysis and FA (Nunnally, 1978). Item reduction through item analysis and FA is a complex, iterative and subjective process (Cabrera-Nguyen, 2010). Worthington and Whittaker (2006: 808) suggest that refining an item pool is a *“... dynamic process of examination and revision, followed by more examination and revision, ultimately leading to a tentative rather than a definitive outcome.”*

### **3.5.3.1 Item analysis**

Prior to item analysis, the item pool should be completed by a sample of respondents. DeVellis (2003) recommends that this be a representative sample of the target population and argues the case for large samples in order to reduce standard error by reducing the systematic variance (Worthington & Whittaker, 2006). Nunnally (1978) suggests that the sample should be large enough to eliminate subject variance and advocates samples of >300 respondents, and preferably over 1,000. However, Kline (2000) argues that as long as a sample is representative of the target population, a sample of ~100 respondents is sufficient. In practice, robust item analysis has been performed on sample sizes well below the 300 recommended. Practical implications such as time constraints, financial constraints, and access to sufficiently large populations, mean that sample sizes of below 100 respondents are common and acceptable (Okuyama et al., 2000).

As discussed previously in section 3.4.2 'Reliability', producing an internally consistent scale is at the heart of the scale development process. This can be achieved through distributing the pool of items to a large and representative sample and selecting a set of highly intercorrelated items using item analysis (DeVellis, 2003). Nunnally (1978) advocates that item analysis be carried out in the early stages of scale development to refine the item pool prior to additional statistical procedures such as FA. The aim of item analysis is to select those items which demonstrate desirable characteristics which can increase reliability and produce a homogenous test (Kline, 2000). Desirable

characteristics for items include those which contribute to the internal consistency (Cronbach's  $\alpha$ ), those with high item-total correlations, those with high variance, and those which have a mean score close to the centre of the range of possible scores (Kline 2000).

Each item in a scale should measure what the test measures and this can be calculated using item-total correlations (Kline, 2000). Items can be selected or removed based on how they perform compared to other items in the scale. A corrected item-total correlation provides the correlation between the item score and the total score, without that item included. If the correlation is low then it can be assumed that that particular item is not measuring the same thing that the rest of the scale is measuring and can therefore be removed.

Another attribute that is desirable in an item, is that it has relatively high variance (DeVellis, 2003). If all respondents answer an item the same way then this will not discriminate between individuals and the variance will be zero. As DeVellis (2003: 94) states "*... an item that does not vary cannot covary.*"

Therefore, a range of responses is required to ensure that an item can differentiate between respondents. Similarly, it is desirable that the mean score for an item is near the centre of the possible range. If the mean is at the extreme end of possible scores then it may indicate that the item is worded poorly and does not allow for a range of possible responses.

Finally, the internal consistency can be maximised by selecting items which positively contribute to  $\alpha$ . Those items which lower the overall  $\alpha$  value can be



highlighted based on the ' $\alpha$  if item deleted' statistic. Removal of these items will result in more reliable scale (DeVellis, 2003). However, it is worth noting that removing an item for a negligible improvement in  $\alpha$  may not be desirable if the scale developer feels that the item 'taps' into a particularly important aspect of the latent variable.

### **3.5.3.2 Factor analysis**

Factor analysis (FA) is a statistical technique that investigates whether items in a scale are linearly related to a smaller number of unobservable factors. FA enables the scale developer to determine how many latent variables underlie a set of items and also to help define what these latent variables may represent. Furthermore, FA can help minimise systematic error by checking for the unidimensionality of the scale (DeVellis, 2003). FA is at the heart of questions of validity and provides a diagnostic tool to evaluate whether the data are in line with the theoretically expected structure of the unobserved construct and thereby to determine if the scale has measured what it purports to measure (Matsunaga, 2010).

As with item analysis, issues regarding minimum sample size for FA have received considerable discussion in the literature (Worthington & Whittaker, 2003). There are two main risks to samples that are too small: (1) patterns of covariance may not be stable, as chance can influence correlations among items when the ratio of participants to items is low, and (2) the development sample

may not adequately represent the intended population (DeVellis, 2003; Worthington & Whittaker, 2006).

There are no strict guidelines for the minimum sample size needed for FA, although a number of criteria are recommended. Most guidelines suggest that sample size should be based upon the number of variables included in the analysis, with more variables requiring larger sample sizes. However, there is little agreement within the literature on what this ratio of sample size to variables should be. For example, Gorsuch (1983) recommends that there should be at least 5 respondents to each measured variable, whilst Nunnally (1978) suggests that a ratio of 10 respondents to each variable is more suitable. Costello and Osborne (2005) examined various respondent-item ratios and found that ratios of 2:1 produced correct solutions just 10% of the time, whereas ratios of 5:1 and 10:1 produced correct solutions 40% and 60% of the time respectively.

MacCallum et al. (1999) argue that minimum sample size is influenced considerable by the extent to which factors are overdetermined (i.e., how many variables there are for each factor) and the level of the communalities of the measured variables. MacCallum et al. (1999) advises that when factors are overdetermined by a ratio of 4:1 and communalities are high (mean >0.7) then accurate FA can be conducted on samples as small as 100. Therefore, it is generally accepted that the stronger the data is, the lower the sample size needs to be for FA.

Whilst sample sizes of over 100 are recommended by most guidelines (Fabrigar et al., 1999; MacCallum et al., 1999), studies have demonstrated good FA recovery on considerably smaller data sets. For example, studies by Barrett and Kline (1981) and Arrindell and van der Ende (1985) demonstrate good recovery in samples of  $n=48$  (respondent-item ratio of 3:1) and  $n=78$  (respondent-item ratio of 3.9:1) respectively. MacCallum and colleagues conducted a large Monte Carlo study exploring the impact of sample size on FA and found communalities were an important factor in successful analysis. In studies that had communalities of  $>0.6$ , acceptable solutions were demonstrated 100% of the time in sample sizes of  $n=60$ . Unfortunately, communalities cannot be calculated in the development stage but they can be used as an important post hoc indicator of whether sample size was adequate (MacCallum et al., 1999).

Although minimum sample size remains a debated issue, sampling adequacy statistics can be calculated prior to FA to ensure that the data is suitable for FA. It is recommended that the Kaiser-Meyer-Olkin (KMO) equation and Bartlett's test of sphericity are calculated to test data suitability (Cabrera-Nguyen, 2010; Worthington & Whittaker, 2006). The KMO statistic varies between 0 and 1. A value of 0 indicates a diffusion in the pattern of partial correlations and the sum of correlations, making FA inappropriate. In contrast, a value of close to 1 indicates that the FA should yield distinct and reliable factors (Field, 2005). Bartlett's test of sphericity tests the null hypothesis that the variables are uncorrelated, thus a significant finding rejects the hypothesis and indicates that the data is suitable for FA (Field, 2005).

There are two distinct methods of FA: exploratory factor analysis (EFA) and CFA. These play different roles in scale development with EFA used for theory-building and scale refinement, and CFA primarily used for theory-testing (Matsunaga, 2010). The focus of this section will be on EFA for the purposes of early scale development. The role of CFA will be discussed in the later section (3.5.4) exploring scale validation procedures.

Before discussing the role of EFA, it is worth exploring the two closely related but often-confused analysis approaches that fall under the rubric of EFA: principal components analysis (PCA) and true FA. Both PCA and FA involve the transformation of a number of (possibly) correlated variables into a smaller number of uncorrelated (PCA) or correlated (FA) variables known as principal components or factors (Wang et al., 2009). The main conceptual differences between PCA and FA are that in PCA the aim is to account for as much of the total variance as possible, whilst the aim of FA is to try to explain the covariances or correlations among the variables. Also, PCA is generally used to reduce the data into a smaller number of components, while FA is used to understand what constructs underlie the data (Wang et al., 2009).

Although these two approaches are both regularly used within scale development, both empirical research and analysis guidelines recommend the use of FA over PCA (Costello & Osborne, 2005; Worthington & Whittaker, 2006). Costello and Osborne (2005) conducted a large study comparing PCA and FA on over 24,000 data sets. Although the two approaches produced similar results,

the authors found that PCA overestimated the variance accounted for by 16.4% compared to FA and also produced over-inflated item loadings. The authors conclude that FA produces more generalizable and reproducible results as it does not inflate the variance estimates. Boyle (1985: 51) summarises the general attitude towards the superiority of FA by suggesting that *“Use of principal components is elegant, but would seem psychologically meaningless in view of the common factor model.”*

EFA assesses the construct validity during the initial development of a scale and is applied to a set of items to examine the underlying dimensionality of the item set (Worthington & Whittaker, 2006). The primary aim of EFA is that it allows the scale developer to identify items that do not measure an intended factor or simultaneously measure multiple factors. These could be poor indicators of the desired construct and can therefore be eliminated from further consideration (Worthington & Whittaker, 2006).

EFA begins with the premise that one latent variable (or factor) containing all of the items is all that is required and then assesses how much of the association among individual items that single concept can explain. If it appears that one latent variable has not accounted for all the covariation between the items, the analysis rejects the initial premise and identifies a second latent variable that explains some of the remaining covariation among items. This process continues until the amount of covariation that the set of factors has not accounted for is acceptably small (DeVellis, 2003).

A large number of factors will usually emerge following EFA (usually the same number of factors as items), yet many of these factors will only explain a small amount of the variance. The scale developer must therefore decide how many factors to retain. Factors are typically retained based on eigenvalues (the amount of information captured by a factor) or by visual interpretation of a scree plot (Field, 2005; O'Rourke et al., 2005). Kaiser's (1960) criterion dictates that all factors with an eigenvalue greater than one should be retained as they represent a substantial amount of variation. However, Cattell (1966) recommends that a graph is plotted (the scree plot) which compares each eigenvalue (y-axis) against the factor (x-axis) with which it is associated (see Figure 3.4). According to Cattell (1966) the cut-off point for selecting factors should be at the point of inflexion (the arrow in Figure 3.4) of this curve. Costello and Osbourne (2005) argue that using Kaiser's criterion alone is inadequate. Therefore, in practice, the majority of scale developers employ a combination of these two methods to ensure that all relevant factors are retained (Field, 2005; O'Rourke et al., 2005).

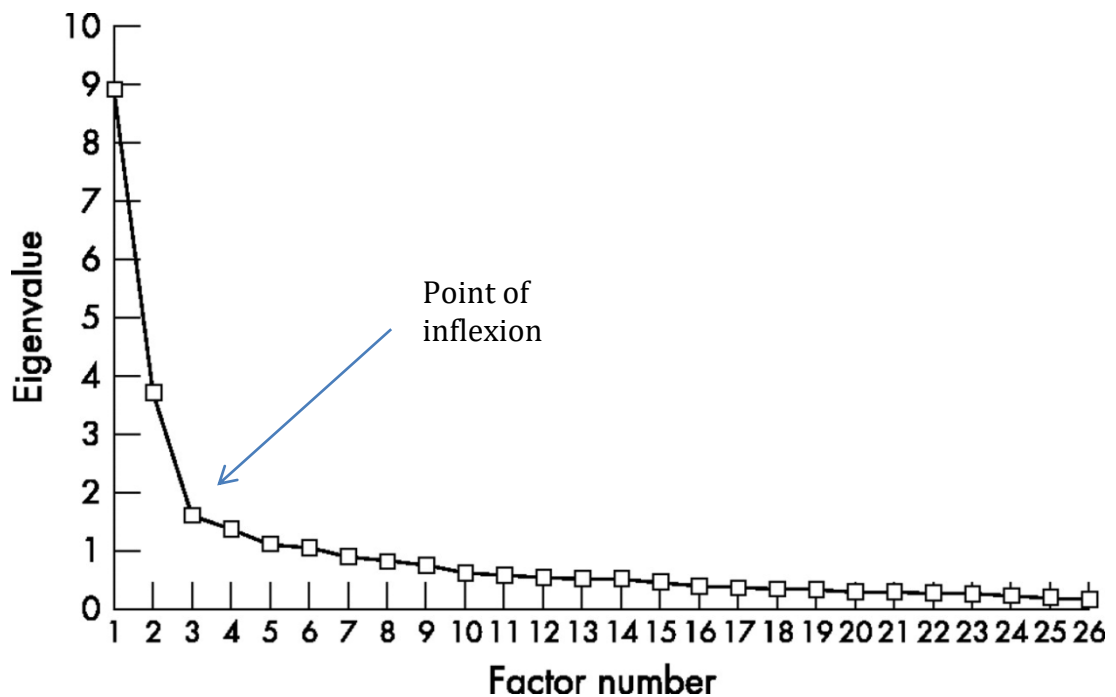


Figure 3.4: Example of scree plot with point of inflexion highlighted

Once the number of factors to be retained have been decided, the scale developer can then explore the loadings of each item onto each factor. If more than one factor is identified then the data must be rotated. If the factor axes are rotated, the loading of a variable on one factor is maximized while its loading on the other factors is minimized, thereby making the factor structure easier to interpret. The two main forms of rotation available are orthogonal rotation and oblique rotation. Orthogonal rotation is used when the factors are not believed to be correlated, whilst oblique rotation enables factor correlations to be explored (Kline, 2000). Those scales that have a clear single-factor structure do not require rotation.

The final stage of EFA is to interpret the retained factors. In cases where the latent variables have been defined *a priori*, there is no need to define the factor.

However, often it is necessary to explore items loading strongly onto a particular factor to “... *provide a window into the nature of the factor in question*” (DeVellis, 2003; 126).

#### 3.5.4 SCALE VALIDATION

The final stage of the scale development process is validation. As Robins et al. (2001: 160) asserts, validation is an on-going process and “...*one never validates a scale but rather provides progressively more evidence for a particular interpretation of the scale.*”

According to the FDA’s (2009) guidance on PROMs, a scale can only be considered a credible measure if it has been validated in the target population. Therefore, scale validation procedures typically involve establishing validity, including criterion and construct validity in a clinical sample that is representative of the population it has been designed for use in.

One of the key aspects of construct validity that can be explored in the scale validation phase is the confirmation of the factor structure through CFA using structural equation modelling (SEM; Redding et al., 2006). CFA is used to test an existing theory, usually to evaluate or confirm the extent to which the researcher’s hypothesised model (typically that produced by prior EFA) is replicated in the sample data. It can also be used to assess the extent to which one model fits the data better than an alternative model (Worthington & Whittaker, 2006).



CFA typically involves specifying the hypothesised model using SEM software and then exploring the fit of the data to the model. Software programmes such as AMOS can be used to model factors and variables on the predetermined model (see Figure 3.5). Model fit is then assessed using a number of indices which establish how well the model fits the data. These include absolute model fit indices such as Chi-square test statistic or Goodness-of-Fit Index (GFI), incremental fit indices such as Normed Fit Index (NFI) or Non-normed Fit Index (NNFI)/Tucker-Lewis Index (TLI), and predictive fit indices, such as the Bayesian Information Criterion (BIC; Worthington & Whittaker, 2006). There are various recommendations for the cut-off values for each of these fit indices (e.g., Hu & Bentler, 1999) and these are discussed in Chapter 6 (section 6.4.3.4.4.3) of this thesis. If poor model fit is found in CFA then researchers are able to modify and retest models based on modification indices. However, it is important to note that such modifications should always be guided by theory (Worthington & Whittaker, 2006).

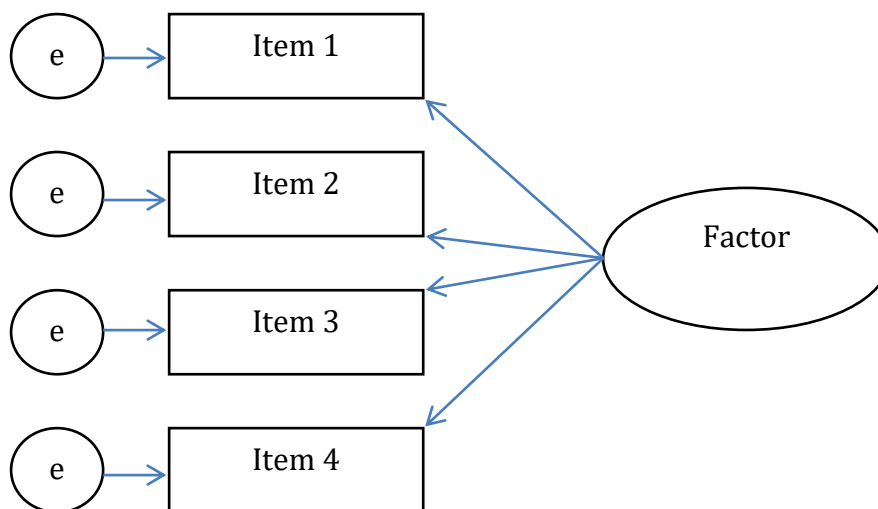


Figure 3.5: Example single factor CFA model

As with the sample size considerations discussed in the previous section on EFA (Section 3.4.3.2), there are no strict guidelines for CFA. Kline (2005) recommends a minimum sample size of 100 participants. However, it is generally accepted that a 5:1 ratio of participants to number of parameters is needed (Bentler & Chou, 1987; Worthington & Whittaker, 2006).

### 3.6 SUMMARY OF CHAPTER 3

This chapter has summarised some of the key considerations relating to the development of self-report scales. The thesis is guided by a CTT approach to scale development which is sample dependent and assumes that items within the scale all measure an underlying latent variable. This theory was chosen over the modern approach of IRT due to limitations in the potential sample size and the availability of complex statistical software. However, empirical evidence support the use of CTT, especially when representative clinical samples can be incorporated in scale development procedures.

At the heart of scale development is the need to establish the reliability and validity of a scale. Reliability refers to both internal consistency (internal reliability) and temporal stability (test-retest reliability), whereas validity is traditionally measured under three criteria: content validity (that items reflect the domain being measured), criterion validity (the accuracy of the scale) and construct validity (the behaviour of the scale).

Scale development is an iterative process which typically follows a sequential course which begins with developing a conceptual model for the scale.

Following item writing, in which important decisions are made regarding the wording of items, their appropriateness in the target population and the development of a response set and format, the item pool is tested on specific clinical sample. Statistical procedures guide the refinement of the new scale.

Both item analysis and EFA can be incorporated to establish the initial internal consistency and latent structure of the scale prior to finalisation. The final stage of validation is an on-going process of evidence gathering in which *a priori* hypotheses regarding the scale's theoretical performance are tested in representative samples. This typically involves comparison with extant measures, establishing screening properties, testing temporal stability and confirming the factor structure through CFA.

## Chapter 4 : METHODOLOGY

### 4.1 INTRODUCTION

The purpose of this study was to develop a novel non-somatic anxiety scale to measure and screen COPD patients for anxiety. The research aims outlined in Chapter 1 guided the choice of research design for this study. The research consisted of three phases that are described in the following chapter. This chapter will outline and justify the chosen research methodology and conceptual framework guiding this research. An overview of the methods employed in each phase is also presented.

### 4.2 CONCEPTUAL FRAMEWORK

This study utilised a pragmatic sequential mixed methods approach to scale development that integrated qualitative and quantitative data into a single study (Durham et al., 2011; Johnson & Onwuegbuzie, 2004; Morrow et al., 2011; Onwuegbuzie et al., 2010) and was based broadly upon the scale development steps recommended by DeVellis (2003) and Redding et al. (2006).

The following section will give an overview of mixed methods and specifically discuss how the pragmatic philosophy can influence the selection and mixing of research methods. Mixed methods approaches to scale development will be explored and the chosen research design will be justified.

Mixed methods is a relatively new approach, which have evolved from the 'mono method era' during which researchers adopted a purely quantitative or qualitative approach to research (Armitage, 2007). Traditionally, researchers in the social sciences fell into two opposing worldviews or paradigms. Tashakkori and Teddlie (1998) adopt the terms "positivist" and "constructivist" to describe the traditional objectivist scientific endeavours of the positivist researchers and the subjective multiple realities of the constructivists.

In this long-running debate, the incompatibility of quantitative and qualitative research was stressed in terms of the fundamentally opposing worldviews, ontology (the nature of reality and whether it exists) and epistemology (how it is possible to know about reality; Glogowska, 2011). The mixed methods design blends the positivist/post-positivist and constructivist paradigms and is considered to be the 'third paradigm' (Glogowska, 2011). 'Mixed methods research' is increasingly becoming the standard terminology for research that involves both qualitative and quantitative research. However, it is still sometimes referred to as 'multi methods' or 'mixed methodology' research (Glogowska, 2011).

A key strength in mixed methods is that a combination of the qualitative and quantitative frameworks allows more potential support than can be achieved by using either qualitative or quantitative methods in isolation (Bryman, 2007). A mixed methods design was chosen for this study as the integrated analysis of both qualitative and quantitative data allow the experiences of the patient to

complement the robust statistical analysis which typifies the scale development process (Mahoney et al., 1995; Onwuegbuzie et al., 2010).

This research is guided by the philosophical underpinnings of pragmatism. Pragmatism is a relatively recent philosophy that allows the mixing of both quantitative and qualitative methodologies and emerged as a challenge to the mono method era in the early 1960s, termed by Tashakkori and Teddlie (1998) as “Paradigm Wars”. Pragmatists consider the research question as central to the choice of approach (Creswell, 2009) and therefore, this “what works” tactic (Armitage, 2007) enables the researcher to address questions that do not sit comfortably within a purely quantitative or qualitative approach to research design and methodology. According to Johnson and Onwuegbuzie (2004) a pragmatic approach should mix research methods in ways that offer the best opportunities for answering important research questions.

Pragmatism is an attractive philosophy to the scale developer because it is grounded in real life practice and enables a freedom of choice that allows the researcher to choose the methods, techniques, and procedures that best meet their needs and purposes, and to make decisions on which methods can be used to maximise the validity and reliability of a scale (Clark & Watson, 1995; Creswell, 2009). The review of scale development in Chapter 3 makes it clear that the development of a scale is dominated by quantitative methods such as item and factor analysis. It has been suggested, however, that using quantitative methods alone for developing scales is often insufficient (Steckler et al. 1992). This may be because certain factors that define a ‘good’ scale, including face

validity and content validity, are subjective in nature and thus lend themselves to qualitative inquiry. To achieve the dual purpose of a robust, reliable and valid scale that is also grounded in 'real life' experience, a pragmatic decision can be made to 'mix' methods by including both qualitative and quantitative methods in complementary ways (Mahoney et al., 1995).

There are a number of mixed method approaches to scale development and these vary in their complexity and in the relative mix of both qualitative and quantitative methods. Writing shortly after the present research commenced, Onwuegbuzie and colleagues (2010) present a comprehensive 10-phase approach that mixes quantitative and qualitative methods throughout the scale development process. Such an approach involves numerous stages of research and crossover analysis and lends itself to the development of poorly understood or complex, multifaceted constructs. As anxiety is a relatively well-understood concept, with many extant scales already in existence, this research incorporates a more simplistic mixed methods approach to scale development that incorporates an additional qualitative phase to aid in the initial item development process (Morrow, 2011).

In the early stages of scale development, mixed methods research permits the use of qualitative methods to help conceptualise the construct of interest and to identify behaviours that underlie the construct prior to the substantive quantitative methods that seek to address issues of reliability and validity (Durham et al., 2011; Kline, 2000; Mahoney et al., 1995; Onwuegbuzie et al., 2010). As a result, there is increasing evidence of the use of mixed methods in

scale development, particularly in studies that seek to develop health-related scales. A number of studies have now been published that utilise a pragmatic mixed methods approach to item development that integrates both emic (qualitative data) and etic (such as literature review) perspectives (Bova et al., 2006; Durham et al., 2011; Mahoney et al., 1995; Onwuegbuzie et al., 2010).

Many guidelines for developing scales discuss the role of conducting literature reviews to aid in item development (e.g., DeVellis, 2003; Streiner & Norman, 2003). However, there is little specific guidance concerned with generating potential items using qualitative methods. Rowan and Wulff (2007) argue that this may be because scale development is still dominated by quantitative methods and therefore little attention is paid to the origin of items, as long as they prove to be reliable and valid. Nevertheless, an increasing number of scale developers have incorporated a qualitative phase of exploratory work in the item development process (Jones et al., 2009b; Michalak et al., 2010; Okuyama et al., 2000; Ushiro, 2009).

Qualitative inquiry can be especially useful to scale development researchers in that the validity of the quantitative research can be enhanced by first being grounded in real life situations through collecting qualitative data (e.g., interviews, focus groups or textual sources) from an open perspective (Mahoney et al., 1995; Padgett, 1998; Rowan and Wulff, 2007). Qualitative inquiry in the early stages of scale development may also enable the researcher to see if there are unexplored or untapped areas of the topic in question (or new informants) that could yield specific new items (Rowan and Wulff, 2007). There



is also a growing acceptance among scale developers that items should be derived from the words used by patients to describe their own symptoms or experiences (Yorke et al., 2010), thus improving scale fidelity (Collins et al., 2006). Examples of qualitative methods used in item development include interviews or focus groups with participants from the target population (Jones et al., 2009b; Okuyama et al., 2000), families and carers (Michalak et al., 2010) and experts in the field e.g., clinicians or academics (Jones et al., 2009b; Michalak et al., 2010; Okuyama et al., 2000).

The benefits of integrating qualitative data in the early stages of item development are particularly significant for this research because although anxiety is a relatively well-defined construct, it is not known whether people with COPD experience anxiety that is similar to those without the disease (Maurer et al., 2010). Therefore, it was decided that a qualitative study that explored the experience of anxiety symptoms from the patients' perspective would enhance the item writing process.

#### 4.3 RESEARCH DESIGN

Comrey (1988), DeVellis (2003), and more recently Redding et al. (2006), provide practical guidelines for developing reliable and valid measurement scales and collectively advocate a sequential process. DeVellis' (2003) eight steps and Comrey's (1988) and Redding et al. (2006) five steps, share a mutual belief that there are three main phases (often consisting of multiple studies) in scale development: a primary phase of initial item generation, a secondary

phase of item reduction, and a third phase of on-going scale validation. This approach has been adopted by scale developers in a range of social science settings (e.g., Bova et al., 2006; Okuyama et al., 2000; Ushiro, 2009; Yesavage & Brink, 1983).

This research followed the iterative scale development process proposed by DeVellis (2003) and Redding et al. (2006) which integrated a contemporary mixed methods approach to item development and was followed by the 'classical' quantitative scale refinement approach (Mahoney et al., 1995; Morrow et al., 2011; Padgett, 1998; Rowan & Wulff, 2007).

Figure 4.1 illustrates the three-phase scale development process used in this research. The first phase involved conceptualising and defining the construct and writing items. This phase incorporated a mixed methods approach which integrated both emic (qualitative interviews) and etic (quantitative review of extant scales) perspectives. The second phase involved refining the scale using quantitative analysis procedures. In the third phase, the resultant scale was validated through quantitative analysis.

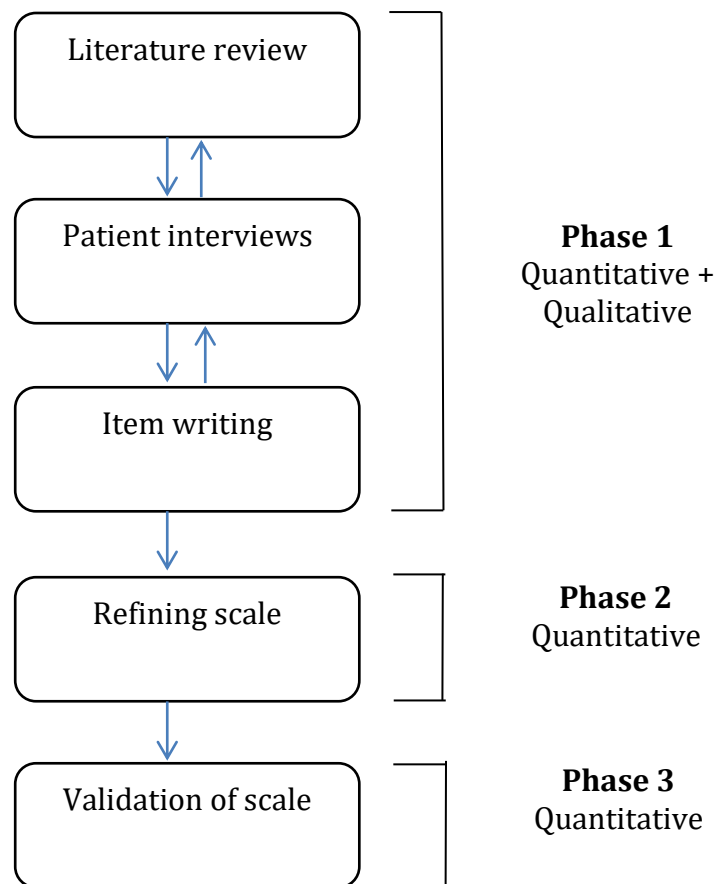


Figure 4.1: The three phase sequential mixed methods approach to scale development used in the present study

The three phases of research reflect the scale development stages proposed by both DeVellis (2003) and Redding et al. (2006). Table 4.1 illustrates how each phase corresponds to the proposed guidelines.

Table 4.1: Phases of research and their corresponding steps according to DeVellis (2003) and Redding et al. (2006)

Stage of process according to guidelines		
Phase of research	<i>DeVellis (2003)</i>	<i>Redding et al., (2006)</i>
<b>Phase 1</b>	Step 1 – Determine what is to be measured	Step 1 – Define construct
	Step 2 – Generate an item pool	Step 2 – Write items
	Step 3 – Determine the format for measurement	
	Step 4 – Have initial item pool reviewed by experts	Step 3 – Pilot test & exploratory work
	Step 5 – Consider inclusion of validation items (N/A)	
<b>Phase 2</b>	Step 6 – Administer items to development sample	Step 4 – Field testing & exploratory work
	Step 7 – Evaluate the items	
	Step 8 – Optimise scale length	
<b>Phase 3</b>		Step 5 – Confirm, analyses, cross-validation

The following paragraphs provide a brief description of the three research phases and the procedures that were involved. Detailed descriptions of each phase, including the specific methods employed are discussed in Chapters 5 and 6.

The first phase of the study generated a pool of potential items that were grounded in both etic and emic perspectives. A strategic review of the literature (see Chapter 2) was conducted to confirm the need for a new tool (Jones et al., 2009b). Following this, a purposive literature review (etic perspective) was conducted which identified extant anxiety scales. A list of items was identified

and these were then subjected to both thematic and content analysis to derive key themes. In addition, qualitative interviews were conducted with patients with COPD (emic perspective) to explore the experience of anxiety, conceptualise anxiety in this research context, and, specifically, to elicit descriptions of anxiety symptoms. Using the themes identified from the review of extant scales, a thematic and content analysis was conducted on qualitative data to identify themes. The themes generated from the etic and emic perspectives were used to write a list of items. The wording, content and readability of these items were then checked by an expert reference group made up of patients and clinicians. The qualitative interviews also allowed an in-depth exploration of the first-hand experiences of anxiety in patients with COPD. Data were analysed using a thematic network approach which enabled basic themes, organising themes and global themes to be generated.

In the second phase of the study, the pool of items generated in Phase 1 was completed by a clinical sample of inpatients and outpatients. These data were then subjected to item analysis and EFA to establish the scale's reliability, to aid in item reduction and to explore the factor structure of the scale. Following statistical analysis, a final scale was developed; the Anxiety Inventory for Respiratory Disease (AIR). Finally, the scale was rated by patients to establish: how easy the scale was to complete, how helpful the scale was in reflecting their experiences, and how easy the scale was to understand.

In the third phase of the study, the AIR was completed on two occasions by a clinical sample of outpatients to determine its reliability (internal consistency

and temporal stability) and validity. The respondents also completed a battery of scales to determine the criterion validity and construct validity of the new scale. A sub-sample of these respondents also underwent a clinical psychiatric interview to aid in establishing sensitivity and specificity properties of the AIR. The data from phase 3 were also subjected to CFA to confirm the factor structure of the AIR.

#### 4.4 SETTING

This research was conducted in the North Western boroughs of Greater Manchester where COPD appears to be particularly prevalent and has a significant impact upon healthcare utilisation and resources. According to the British Lung Foundation's *Missing Millions* report (2007), Manchester faces the sixth greatest challenge from COPD in the UK and the fourth greatest in England. People in Manchester are 40% more likely to be admitted to hospital through COPD than the UK average. The report highlights that those individuals who are at risk of future hospital admission with COPD live mostly in socioeconomically deprived areas such as those covered by the two NHS trusts which participated in the current research: Pennine Acute Hospitals NHS Trust and Tameside Hospital NHS Foundation Trust. Even though Manchester is experiencing a period of unprecedented and continued economic growth, it still has high and enduring levels of deprivation and unemployment is a major issue (British Lung Foundation, 2007).

## 4.5 ETHICAL CONSIDERATIONS

This research received approval from the Lancaster NHS National Research Ethics Service (NRES) committee (see Appendix 1) and the Manchester Metropolitan University (MMU) research ethics committee (see Appendix 2). A number of factors were taken into account during the planning of this research. These are discussed below along with steps that were taken to minimise potential issues.

### *4.5.1 RISKS, BURDENS AND BENEFITS FOR RESEARCH PARTICIPANTS*

In Phase 1, participants discussed themes relating to anxiety, panic and general mental health that may have been potentially distressing. However, understanding the experiences of the patient was a key objective of this research and it was felt that a first-hand account of the experience as told by the participant was the best way to achieve this. To minimise any possible distress, participants were able to take breaks from or terminate an interview at any time. In addition, if the author was concerned about the participant's anxiety then their GP was contacted with permission of the participant (see Appendix 3 for example GP letter).

There was also the potential that the interview process would provide an additional inconvenience to participants in terms of a time burden. Participants were required to give up to 2 hours of their time for the interview process (including introductions, gaining consent etc.). To minimise this burden

interviews were conducted at the participant's home (if requested) so that no travel time or expense was incurred. Also, participants were free to choose a day and time which best suited them. The decision to interview patients in their own home may have been seen as an intrusion by some participants. In such cases an alternative interview location was arranged which was accessible to the participant; a local outpatient clinic.

Participants who had severe respiratory disease may have become breathless during the interviews. In such cases, participants were given the opportunity to take frequent breaks throughout the interview process. In cases of severe breathlessness, interviews could be postponed to another date or split over a number of days. In all cases the participant was consulted on this prior to and during the interview.

In Phases 2 and 3, participants completing the draft scale may have experienced some emotional distress as the items included topics relating to fear and worry. In order to minimise distress, the GP of the participant was contacted by letter (with permission) if the author was concerned about the participant's anxiety.

In Phase 3, participants were posted follow-up scales to be completed two weeks after recruitment. There may have been a time burden associated with the completion of the scales, so to minimise this participants were given 7 days in which to complete and return the scales. A pre-paid envelope was also provided to minimise further inconvenience and costs to the participant.



Although there were no direct benefits to participating in this research, it was hoped that the findings could be used to improve the care of patients with COPD in the future.

#### *4.5.2 RECRUITMENT AND INFORMED CONSENT*

In Phase 1, all potential participants were recruited in person by the author who explained the research and answered any questions related to the study. In Phase 2, potential participants were recruited by the author or a trained research assistant. In Phase 3, participants were recruited either by postal invitation or in person by the author.

All potential participants were given a Participant Information Sheet and Informed Consent Form corresponding to that phase of the research. These are detailed in Chapters 5 and 6, with example forms provided in appendices 4, 5, 8, 9, 12 and 13. All participants were given 24 hours to decide whether they wished to participate in the research. Written informed consent was obtained by either the author or the research assistant.

#### *4.5.3 CONFIDENTIALITY AND ANONYMITY*

All information collected during this research was anonymised with a unique code that was only known to the author. The following procedures were also implemented to ensure confidentiality and anonymity:

- Personal details were encrypted and stored on a computer protected with a firewall. The computer was also kept in a locked room which was only accessible to PhD students.
- Data contained on paper was locked in a filing cabinet which was only accessible to the author.
- All direct quotes were anonymised using pseudonyms.
- All audio recording devices were kept in a locked storage area and were wiped clean of data once the files had been transferred and encrypted on the computer.
- Access to data at the University was restricted to the author. All information was password protected and kept on computers protected by a firewall.

#### 4.6 SUMMARY OF CHAPTER 4

This chapter detailed the methodology of the current research. The conceptual framework of the research was guided by the philosophical underpinnings of pragmatism and a mixed methods research design was chosen to incorporate both emic and etic perspectives during item development. The research consists of three phases: item development (qualitative and quantitative), scale refinement (quantitative) and scale validation (quantitative), and follows a classical approach to scale development described by DeVellis (2003) and Redding et al. (2006). Finally, a number of ethical concerns were considered and efforts to minimise participant risks and burden and to maximise benefits, confidentiality and anonymity were explored.

The next chapter describes Phase 1 of the research in which emic and etic perspectives were integrated to develop a pool of potential items for the new anxiety scale. In addition, detailed experiences of anxiety were explored from the patients' perspective.

## Chapter 5 : PHASE 1 – ITEM DEVELOPMENT

### 5.1 INTRODUCTION

This chapter will outline the mixed methods approach to item development in the present study (DeVellis, 2003; Redding et al., 2006). According to Keedwell and Snaith (1996), the first step in developing a scale for clinical use is to develop a pool of items that are relevant to the patients for which the scale is designed. The primary goal of Phase 1 of the research, therefore, was to develop items that were grounded in the experience of anxiety from the patients' perspective.

An inductive approach to item development was used, with potential items developed by combining two distinct approaches. First, a review of extant anxiety scales was undertaken (Phase 1.1) which permitted a thorough exploration of the content of existing items and enabled the full coverage of non-somatic anxiety symptoms. The second approach involved developing content for items *de novo* through a qualitative study of patients' experiences of anxiety (Phase 1.2). Exploration of the experience of anxiety can aid in conceptualising the construct and confirming the need for a new scale. As has been outlined in the previous chapter (Chapter 4), this mixed methods approach to item development enables enhanced scale validity and fidelity, and ensures that the item pool covers all aspects of the construct.

## 5.2 PHASE 1 AIMS

### *5.2.1 PRIMARY AIMS*

1. To develop a pool of representative items that will contribute towards developing a scale to measure and screen for anxiety in patients with COPD.

### *5.2.2 SECONDARY AIMS*

2. To gain a deeper understanding of the experience of living and coping with anxiety in patients with COPD.
3. To explore the need for a new anxiety scale for patients with COPD.

## 5.3 PHASE 1.1: REVIEW OF EXISTING ANXIETY SCALES

### *5.3.1 INTRODUCTION*

This initial study was designed to explore the symptoms of non-somatic anxiety present in extant anxiety scales. Therefore, existing anxiety scales were analysed and categorised according to their content.

### *5.3.2 PHASE 1.1 AIMS*

The specific aims of Phase 1.1 were:

- a) To identify non-somatic anxiety symptoms from extant anxiety scales.
- b) To explore the symptom coverage of extant anxiety scales

### *5.3.3 METHODS*

A multi-database literature search of Ovid MEDLINE (R), Embase, CINAHL and PsychINFO was conducted to identify extant anxiety scales. Databases were searched from their inception to 30 April 2010. The search terms were “anxiety/ OR panic”, AND “scale/ OR inventory/ OR instrument/ OR test/ OR index/ OR questionnaire/ OR checklist.” The inclusion criteria for reviewed scales were those that: (1) can be completed as self-report instruments, (2) assess state anxiety or panic (including GAD and PD) in clinical settings, (3) contain multiple items, (4) are available and validated in English, and (5) have documented reliability and validity in clinical populations. Scales were excluded if they were: (1) designed to assess other specific anxiety disorders such as PTSD or specific phobia; and (2) designed to assess for severity of pre-diagnosed anxiety disorders, for example, Panic Disorder Severity Scale – Self Report (PDSS-SR; Houck et al., 2002).

The full texts of all relevant scales were accessed and the published versions of scales were retrieved by the author. This enabled a list of items contained within extant scales to be collated. A psychiatrist was also approached to check for any scales used in UK clinical practice that had been missed in the literature search. The following data were extracted from retrieved scales:

- Timeframe
- Item wording
- Response set
- Scoring options

Items were examined for general symptom themes and inductively coded using an open coding framework. In accordance with the aims set out in Chapter 1, somatic items were excluded from the pool of items. In addition, sleep-related items were excluded from the item pool because of the documented overlap between anxiety, symptoms of COPD and the side-effects of medication (Shackell et al., 2007). Finally, items that were unrelated to GAD or PD were excluded. Following coding, items were categorised according to content and the frequency of their occurrence was calculated. The categorisation and coding process was discussed with the supervisory team as well as with the psychiatrist.

#### *5.3.4 RESULTS*

A total of 14 self-report anxiety scales were identified which covered a range of anxiety-related symptoms (see Table 5.1). The majority of scales were measurement tools, however, one scale – the Generalised Anxiety Disorder-7 (GAD-7; Spitzer et al., 2006) – was designed primarily as screening tool for GAD, but can also be used for measurement purposes.

Table 5.1: Characteristics of reviewed anxiety scales used in Phase 1.1

Scale	Type of scale	Nº of anxiety items	Timeframe	Type of response option	Nº of response options	Score range
Beck Anxiety Inventory (BAI; Beck et al., 1988)	Measurement	21	7 days	Likert	4	0-63
Cognitive-Somatic Anxiety Questionnaire (CSAQ; Schwartz et al., 1978)	Measurement	14	-	Likert	5	14-70
Depression Anxiety Stress Scale (DASS; Lovibond & Lovibond, 1995)	Measurement	14	7 days	Likert	4	0-42
Generalised Anxiety Disorder-7 (GAD-7; Spitzer et al., 2006)	Measurement & screening tool	7	14 days	Likert	4	0-21
Geriatric Anxiety Inventory (GAI; Pachana et al., 2007)	Measurement	20	7 days	Agree/disagree	2	0-20
Goldberg Anxiety and Depression Scale (GADS; Goldberg et al., 1988)	Measurement	9	Recently	Yes/no	2	0-9
Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983)	Measurement	7	7 days	Likert	4	0-21
Mental Health Inventory-38 (MHI-38; Veit & Ware, 1983)	Measurement	9	1 month	Likert	6	9-54
Mind Over Mood Anxiety Inventory (MOMAI; Greenberger & Padesky, 1995)	Measurement	24	7 days	Likert	4	0-72
The Penn State Worry Questionnaire (PSWQ; Meyer et al., 1990)	Measurement	16	-	Likert	5	16-80
Self-rating Anxiety Scale (SAS; Zung, 1971)	Measurement	20	Several days	Likert	5	20-80
Short Anxiety Screening Test (SAST; Sinoff et al.,	Measurement	10	-	Likert	4	10-40



Scale	Type of scale	Nº of anxiety items	Timeframe	Type of response option	Nº of response options	Score range
1999)						
State-Trait Anxiety Inventory (STAI; Spielberger et al., 1983)	Measurement	20 (state anxiety)	'Right now'	Likert	4	20-80
Symptom Checklist-90 (SCL-90; Derogatis et al., 1973)	Measurement	10	7 days	Likert	5	0-40

Scales contained between 7 and 24 anxiety-related items and most scales incorporated a Likert-type response set, although the GAI (Pachana et al., 2007) and the Goldberg Anxiety and Depression Scale (GADS; Goldberg et al., 1988) utilised dichotomous response options. The response sets for Likert-type scales ranged from 3 to 6, with a median value of 4. Timeframes varied from 7 days to 1 month, yet four scales (Cognitive-Somatic Anxiety Questionnaire, CSAQ, Schwartz et al., 1978; GADS; Self-rating Anxiety Scale, SAS, Zung, 1971; STAI) did not quantify the timeframe and instead used descriptors to guide the respondent e.g., ‘recently’ or ‘typically’.

Dizziness, light-headedness, faintness	Indigestion
Dry mouth	Flushed face
Sweating	Muscle weakness
Chills	Butterflies in stomach
Shaking, trembling	Choking sensations
Muscle tension, muscle soreness	Frequent urination
Headaches	Swallowing problems, lump in throat
Back pain, neck pain	Numbness, tingling
Breathlessness	Nausea
Tachycardia, heart palpitations	Chest pain

Figure 5.1: Somatic anxiety symptoms identified in extant scales used in Phase 1.1

From the fourteen identified scales, 201 anxiety-related items were found. Eleven scales (containing 65 items) were found to contain items relating to somatic anxiety symptoms e.g., breathlessness, dizziness etc. (see Figure 5.1 for

examples). Three scales – the GAD-7, the Penn State Worry Questionnaire (PSWQ; Meyer et al., 1990) and the STAI – contained no somatic items. On average, in scales that contained somatic items, 36% of items were somatic (see Table 5.2). Eight items from 4 scales were found which related to sleep and these were subsequently excluded from the analysis. Two additional items were removed for being non-specific – one item from the STAI and another from the Symptom Checklist-90 (SCL-90; Derogatis et al., 1973).

Table 5.2: Numbers and proportion of somatic items in extant scales used in Phase 1.1

Scale	Number of somatic items	Somatic items as % of total
BAI	14	67
CSAQ	7	50
DASS	8	57
GAI	4	20
GADS	2	22
HADS	1	14
MHI-38	1	11
MOMAI	11	46
SAS	12	60
SAST	3	30
SCL-90	2	20
<b>Mean</b>	<b>6</b>	<b>36</b>

BAI, Beck Anxiety Inventory; CSAQ, Cognitive-Somatic Anxiety Questionnaire; DASS, Depression Anxiety Stress Scales; GAI, Geriatric Anxiety Inventory; GADS, Goldberg Anxiety and Depression Scale; HADS, Hospital Anxiety and Depression Scale; MHI-38, Mental Health Inventory-38; MOMAI, Mind Over Mood Anxiety Inventory; SAS, Self-Rating Anxiety Scale, SAST, Short Anxiety Screening Test; SCL-90, Symptom Checklist-90

The final number of non-somatic items subjected to categorisation was 126. Items varied in their wording, ranging from short, single-word statements of symptoms (e.g., *"Restlessness"*; Mind Over Mood Anxiety Inventory, MOMAI, Greenberger & Padesky, 1995) to more detailed questions relating to anxiety symptoms (e.g., *"During the past month, how much of the time have you felt restless, fidgety, or impatient?"*; Mental Health Inventory-38, MHI-38, Veit & Ware, 1983). A content analysis of the 126 remaining items was conducted to identify common symptom categories across the scales. Four main categories were identified: *psychic tension*, *apprehension*, *panic*, and *behavioural*. Within these main categories, 12 specific symptom themes were identified representing a range of cognitive and behavioural anxiety symptoms. Table 5.3 illustrates the 12 symptom themes and the corresponding scales that contained items related to each symptom.

Table 5.3: Non-somatic symptom themes and corresponding scales used in Phase 1.1

Organising category	Theme	N° of scales containing theme	BAI	CSAQ	DASS	GAD-7	GAI	GADS	HADS	MHI-38	MOMAI	PSWQ	SAS	SAST	STAI	SCL-90
Psychic tension	Nervousness	8	X			X	X			X	X		X	X	X	
	Tenseness or restlessness	8				X		X	X	X	X		X		X	X
	Irritability	4				X		X			X			X		
	Inability to relax	8	X			X	X	X	X					X	X	X
	Difficulty concentrating	3		X			X				X					
Apprehension	Fear	11	X	X	X	X	X		X		X		X	X	X	X
	Emotional	4					X			X			X		X	
	General worry	11		X	X	X	X	X	X	X	X	X		X	X	
	General anxiousness	6		X	X	X	X			X			X			
Panic	Panic	4			X				X				X			X
	Fear of losing control	4	X								X		X	X		
Behavioural	Avoiding anxiety inducing situations	1									X					

BAI, Beck Anxiety Inventory; CSAQ, Cognitive-Somatic Anxiety Questionnaire; DASS, Depression Anxiety Stress Scales; GAD-7, Generalized Anxiety Disorder-7; GAI, Geriatric Anxiety Inventory; GADS, Goldberg Anxiety and Depression Scale; HADS, Hospital Anxiety and Depression Scale; MHI-38, Mental Health Inventory-38; MOMAI, Mind Over Mood Anxiety Inventory; PSWQ, Penn State Worry Questionnaire; SAS, Self-Rating Anxiety Scale, SAST, Short Anxiety Screening Test; STAI, State-Trait Anxiety Inventory; SCL-90, Symptom Checklist-90

Some scales contained more than one item for each symptom theme. For example, the MHI-38 contained three items that were grouped under the theme *nervousness*. The most common anxiety symptoms found in extant scales were *fear* and *general worry*, which were included under the organising theme of *apprehension*. There was some reference to symptoms of panic, although only seven scales contained items relating to this theme. Behavioural anxiety symptoms were included by just one scale – the MOMAI. This single item referred to avoidance of situations that might induce anxiety.

In general, extant scales did not cover the full range of anxiety related symptoms. The greatest coverage was found in the MOMAI, which included eight of the 12 symptom themes identified in the analysis. With the exception of the MOMAI and the PSWQ, scales covered between four and eight of the anxiety symptoms. The PSWQ, a scale that focuses specifically on the worry aspect of anxiety, contained 16 items, which all fell under the theme of *general worry*.

### 5.3.5 KEY FINDINGS

This study identified 14 anxiety scales that are used to assess anxiety in clinical settings. Analysis identified 12 anxiety symptoms under the four categories of *psychic tension*, *apprehension*, *panic* and *behavioural*.

## 5.4 PHASE 1.2: INTERVIEWS WITH PATIENTS

### *5.4.1 INTRODUCTION*

In order to understand fully the experiences and manifestations of anxiety among patients with COPD, it is important to elicit the stories of individuals who have had first-hand experience of anxiety. Phase 1.2 was designed to gain a deeper understanding of the experience of anxiety through qualitative interviews with patients and, as a result, to enhance theoretical clarity by determining whether underlying theoretical positions reflect the patients' experience.

### *5.4.2 PHASE 1.2 AIMS*

The specific aims of Phase 1.2 were:

- a) To identify new scale items through mapping reported anxiety symptoms in patients with COPD with those identified in Phase 1.1.
- b) To explore experiences of living and coping with anxiety in patients with COPD.
- c) To explore the need for a new anxiety scale for use in patients with COPD.

### 5.4.3 METHODS

#### 5.4.3.1 Design

An exploratory qualitative approach was utilised to explore patients' experiences of living and coping with symptoms of anxiety alongside their COPD. Data were collected through in-depth, semi-structured interviews conducted by the author. The author explained the purpose of the research and the criteria for inclusion to groups of patients at PR and Breathe Easy community support groups in the Greater Manchester region and eligible participants were given a Patient Information Sheet (see Appendix 4) and an Informed Consent Form (see Appendix 5). The criteria for inclusion were individuals who had a documented primary diagnosis of COPD ( $FEV_1 \leq 80\%$  predicted and an  $FEV_1 / FVC$  ratio  $\leq 0.7$ ; NICE, 2010), had self-reported symptoms of anxiety, and were able to describe their experiences.

Once written informed consent had been obtained, interviews were conducted at either the participant's local outpatient clinic, or at their home, with participants free to choose the time and location of the interview. Prior to interview, participants were asked to give socio-demographic details and to complete the HADS (see Appendix 6). The HADS data was used to help describe the severity of anxiety and depression symptoms across the sample. The psychometric properties of the HADS have been described in Chapter 2. The HADS was chosen for this study as it provides an insight into levels of anxiety and depression symptoms. Despite the documented limitations (see section



2.1.8.4), the HADS is the most common scale used in research and clinical settings relating to COPD.

#### **5.4.3.2 Participants**

This study sought to elicit data from people of various age groups and disease severities so that a comprehensive picture of experiences could be explored in a diverse sample. Data were collected from a purposive nonprobabilistic sample of 14 participants with COPD. The participants for this study were recruited from PR and Breathe Easy support groups in Greater Manchester. Potential participants were approached by the author who attended Breathe Easy group meetings and PR classes and explained the purpose of the research and the eligibility criteria. Those recruited from PR were all undergoing an 8-week programme of rehabilitation incorporating exercise and disease-education components. The remaining participants were members of the Breathe Easy support network, a regional network of support groups run by the British Lung Foundation. Breathe Easy groups are held within local communities and usually meet monthly. Typical group activities include social events, fundraising and disease education.

Participants' characteristics are outlined in Table 5.4. The participants were five men and nine women and their ages ranged from 43 to 76 years. Four participants were living alone at the time of the study, nine lived with their spouse and one lived with an elderly parent. On average, participants had been diagnosed with COPD for six years and, typically, had a smoking history of 20

pack years. A pack year is equal to smoking 20 cigarettes (one pack) per day for one year, or 40 cigarettes per day for half a year, and so on. Five of the participants had never smoked. Of the nine who had smoked, none were current smokers and had ceased smoking an average of 10 years ago. Of the 14 participants, three used supplementary oxygen for up to 2 hours a day, 10 used no supplementary oxygen, and one was on 24-hr oxygen via a nasal cannula. One participant was awaiting a double lung transplant and was attending PR as preparation for their surgery. Only one participant was currently employed (part-time), the other 13 were retired. All retired participants indicated that they had ceased employment prematurely because of their respiratory disease.

Table 5.4: Interview participant characteristics in Phase1.2

<b>Age (years) mean (SD)</b>	62.3 ( $\pm$ 9.9)
<b>Sex (n)</b>	
Male	5
Female	9
<b>Recruitment site (n)</b>	
PR	6
Breathe Easy group	8
<b>Interview location (n)</b>	
Participant's home	9
Local hospital	5
<b>Smoking status (n)</b>	
Never smoked	5
Previous smoker	9
Current smoker	0
<b>Smoking history (pack years)<sup>a</sup> mean (SD)</b>	19.5 ( $\pm$ 18.0)
<b>Use of supplementary O<sub>2</sub> (n)</b>	
None	10
$\leq$ 2 hrs./day	3
24 hrs./day	1
<b>HADS mean (SD)</b>	
Total score	17.8 ( $\pm$ 7.7)
Anxiety score	9.9 ( $\pm$ 5.5)
Depression score	7.9 ( $\pm$ 4.2)

<sup>a</sup> One pack year = 20 cigarettes/day for 1 year

PR: pulmonary rehabilitation; HADS: Hospital Anxiety and Depression Scale

Five of the participants had a past clinical diagnosis of GAD for which four had taken medication. In all cases, medication had been discontinued 6-12 months previously. Two participants had received psychological support in the form of counselling from a clinical or counselling psychologist; this, too, had been discontinued in the previous year. Participants' mean HADS score was 10 (range 5-18) for the anxiety subscale and 8 (range 3-17) for the depression

subscale. Using a cut-off score of eleven on the anxiety subscale of the HADS (Bjelland et al., 2002), six of the participants were identified as having a clinically significant symptoms of anxiety. In addition, five participants had clinically significant symptoms of depression based on a score of  $\geq 8$  on the depression subscale of the HADS. Four participants had both clinically significant symptoms of anxiety and depression. Six participants had neither anxiety or depression.

#### **5.4.3.3 The interview**

The interview was conducted in a conversational style and the questions were based around a topic guide aimed at eliciting the participant's experience of anxiety, a particular focus upon the symptoms they had experienced, and how this had impacted upon their lives. The interview was preceded by a short period of scene setting. Following this period, the remaining interview was recorded using an Olympus VN713PC voice recorder (Olympus, UK).

Participants were asked to share their story of their respiratory disease and the effect this had on their lives. Following this, participants were asked to explore the impact that COPD had on their mental health, with a particular focus on experiences of anxiety. Participants were asked to recall episodes where they had felt anxious and were encouraged to provide examples of significant events or experiences. For the focus of the interview, the participants were asked to describe their symptoms of anxiety in detail and what they felt were the causes or triggers of anxious episodes. Participants were then asked to explore the

impact of anxiety on their lives and to discuss any management or coping strategies which they had found helpful. Finally, participants were given the opportunity to add any additional information that they felt was relevant.

Participants were free to take breaks at any time during the interview, particularly if they became breathless or had an episode of prolonged coughing. They were also offered the opportunity to stop at any time during an interview and if necessary, to proceed at a later date. No participants required this. Interviews lasted between 30 and 90 minutes.

#### **5.4.3.4 Data analysis**

Interviews were transcribed verbatim and transcripts were coded in NVIVO (version 9) qualitative software. Data were subjected first to a thematic analysis by the author using a thematic network analysis approach (Attride-Stirling, 2001), an approach which has been utilised widely within health and social science research (e.g., Goodacre & Candy, 2011; Hancock et al., 2006; Marshall et al., 2008). Thematic network analysis aims to facilitate and structure the development of themes salient within the text. Using web like illustrations that summarise the main themes constituting a piece of text, thematic networks are able to offer a visual tool for interpretation and exploration by the researcher. Thematic networks can also act as a tool for the reader who is able to anchor the researcher's interpretation on the summary provided by the network (Attride-Stirling, 2001).

The thematic network is developed starting from a basic theme and working inwards toward a global theme. The process of analysis constitutes three steps: (1) extraction of the lowest order premises evident in the text (basic themes); (2) categories of basic themes are grouped together to summarise more abstract principles (organising themes); and (3) superordinate themes are generated which capture the text as a whole (global themes).

In order to enhance the dependability (reliability) of the findings, coding and basic themes were checked by another member of the research team. In addition, credibility (validity) was enhanced by checking the findings with members of a local Breathe Easy group.

Following the thematic network analysis, the data were examined specifically for symptoms of anxiety through content analysis. The four categories and 14 symptom themes identified in the previous review (Phase 1.1) were used as a basis for a focused coding strategy (Saldana, 2009). Additional symptoms that were not previously identified were also recorded. A frequency count of the symptoms present among participants was conducted and these were mapped against those from the extant scale review (Wiitavaara et al., 2009). Additional themes that were not identified in previous scales were also subjected to content analysis. The coding and categorisation of anxiety symptoms was discussed within the research group as peer review (Creswell, 2007).

Data collection was stopped after 14 interviews had been conducted, because it was felt that data saturation had been achieved and that no new information was forthcoming.

#### *5.4.4 RESULTS*

##### **5.4.4.1 Thematic network analysis**

Following the first analysis, three thematic networks were developed, each with a global theme: relationships with breathing, fighting for control, and panic attacks as life changing. Figure 5.2 illustrates the thematic networks which were developed during thematic analysis.

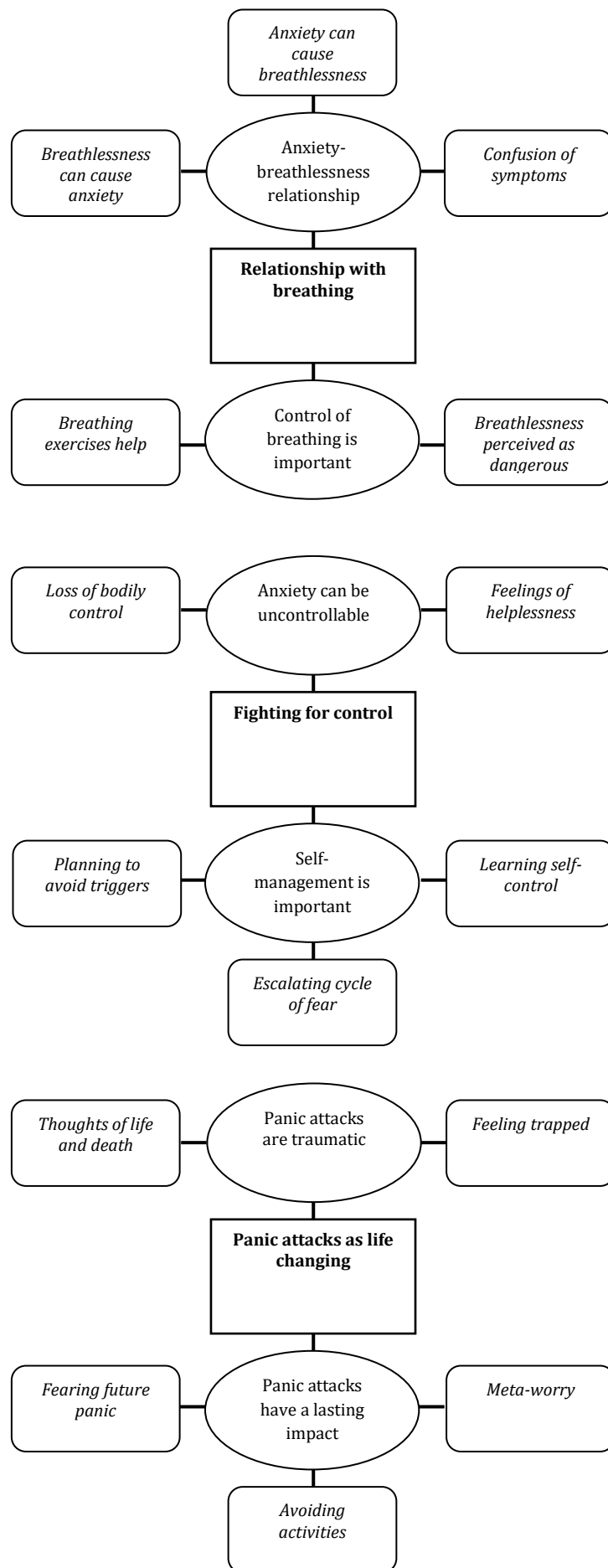


Figure 5.2: Three thematic networks identified in Phase 1.2



#### 5.4.4.1.1 Relationships with breathing

##### 5.4.4.1.1.1 Anxiety-breathlessness relationship

This organising theme pertains to the intricate relationship between breathing and anxiety that was identified by participants. The presence of anxiety was described as both a symptom and cause of breathlessness. For many, breathlessness was treated as a trigger of anxiety or panic, particularly during episodes of more severe breathlessness:

*“Very often, if you have had a very severe bout of coughing... then you can be short of breath again... it can cause you to start to panic, and you think ‘god I have cleared all that muck off my lungs, and I still can’t get my breath.’”*

For others, episodes of anxiety were often idiopathic and could be triggered by a number of situations including social discomfort, such as feeling embarrassed:

*“I tend to get panicky when I go out... Because when people are looking at you, you start to panic a bit.”*

Others found that specific triggers such as misplacing medication caused them to become anxious. These individuals reflected on episodes of acute anxiety which were initiated by emotional triggers rather than breathlessness:

*"... and there wasn't an inhaler. And you think 'huh, I haven't got any inhalers,' and you get all worked up. At first when it first happened I was like 'oh my god!'"*

The relationship between anxiety and breathing was described as a vicious circle by several participants who experienced a downward spiral of escalating breathlessness and anxiety. These events were recalled with fear, partly because of their predictable but uncontrollable nature:

*"It's like a vicious circle. Your breathing gets bad so you get anxious, then you get afraid, and your breathing gets worse, which makes you more afraid. The COPD feeds the anxiety and the anxiety feeds the fear."*

Living with anxiety was seen as a challenge for some, which was further complicated by the confusion and overlap of physical symptoms. Although these participants were sometimes aware that they were experiencing symptoms of anxiety, the overlap between symptoms of COPD, anxiety, and the side effects of medication complicated the recognition of such episodes. In addition, this confusion of symptoms was often stressful and led to heightened levels of anxiety:

*"When you are having a panic attack... your breathing quickens, you struggle to breathe, your heart rate quickens, you are sweating, you are trembling. Is it because you have taken too much salbutamol? Is it because the anxiety has kicked off? Has the anxiety kicked off the COPD? Or, has the COPD kicked off the anxiety?"*

#### 5.4.4.1.1.2 Control of breathing is important

The relationship between breathing and anxiety, combined with the confusion of symptoms, resulted in a fear of breathlessness. In turn, this fear of becoming breathless led to the avoidance of activities which were treated as potential triggers for anxiety. This was a barrier to normal life that also led to a downward spiral of deconditioning where reduced exercise tolerance caused by activity avoidance resulted in a greater likelihood of, and sensitivity to, breathlessness. The disabling nature of breathlessness avoidance was seen as a major barrier to living a normal life:

*"You think 'I will get worse if I move,' so you find your capability to do physical things are pushed back... Cleaning windows, doing the gardening, exercising the dog, walking a distance or up a hill, it gets eroded bit by bit because you fear of being breathless and being caught out and there being no one to help."*

Among the confusion of symptoms and the vicious cycle of breathlessness and anxiety, breathing was identified as manageable through regulating activity and breathing exercises. Participants who had adjusted to their anxiety were aware of the need to break this vicious cycle and therefore utilised a number of breathing exercises including pursed lip breathing and breathing pattern control:

*"You have just got to slow your breathing down completely... train yourself to take a deep breath in and then blow it out... sometimes you are out of breath and you*

*start to think 'oh I can't do it' ... you have got to really train yourself to be able to do this... it doesn't always work and that is when I feel the panic again. And then you have got to stop yourself and think 'I can do it'. I tend to talk to myself all of the time."*

It was through PR or contact with healthcare professionals that individuals were made aware of their anxiety and given an explanation of what they were experiencing. These clinicians were able to offer advice on the recognition of anxiety and recommend effective coping strategies which participants were able to implement.

#### *5.4.4.1.2 Fighting for control*

##### **5.4.4.1.2.1 Anxiety can be uncontrollable**

Participants recalled experiences of acute anxiety and panic as a fight for control. This organising theme relates to how participants viewed their life with anxiety as a constant battle for control over their situation, often unsuccessfully. Panic led to feelings of vulnerability and loss of bodily control, such as incontinence or profuse sweating:

*"I lost control of my bladder. And you know what you are doing and you think 'I have got to get to the toilet,' you know? But you can't."*

These experiences were characterised by an acute awareness of the situation, but an inability to manage. During episodes of panic, anxiety took over to the point that participants felt helpless:

*“Sometimes there is nothing that I can do. I try and take control and put my mind on other things. I just sit there but I can’t take control.”*

#### **5.4.4.1.2.2 Self-management is important**

In many cases, participants were able to take control of their situation after a short period of helplessness. The point at which control was regained varied and was unpredictable. However, the process of taking control was characterised by a logical and systematic thought process and helplessness was replaced by a conscious effort to regain control through self-talk and focus:

*“I have just got to sit down and say to myself ‘stop it’. And look at something and focus on it and physically slow my breathing down... you have got to completely take control.”*

Self-talk was an important management strategy and was a critical part of being in control of one’s situation. Through self-talk and reflection on past events, patients were able to assess the relative risk of their situation and were able to take positive steps toward avoiding a panic attack. This concept of self-management was important to participants who felt that they had once had

little control over their own situation. Self-management had been facilitated by healthcare professionals and through engaging with peers:

*"I'm not saying I haven't had any [panic attacks]. I have felt some coming on but I can manage them. She [the nurse] said 'you can't die from a panic attack, you know?'... And I have imprinted that in my mind ... 'you have got to get your breathing right, don't panic'... It's all to do with just calming yourself down and breathing slowly and deeply."*

The battle for control over one's daily living was seen as a vital part of preventing episodes of panic. Planning was a key element in effective self-management and was seen as a way of preventing situations that might trigger panic attacks. Despite this, the constant planning had a negative consequence in causing excessive worry. Paradoxically, in aiming to prevent panic attacks, participants' incessant planning led to an increase in levels of anxiety:

*"Your whole life revolves around 'how close will I be able to park?' I will have to go half an hour earlier than everyone else and then I can make sure I get a parking space. And 'how far away from the room are the toilets?' Things that everybody else takes for granted."*

Some participants described their battle to be in control as a potential trigger for episodes of panic. Medication was recognised as an aspect of COPD management that was controllable and therefore became an integral part of everyday life. However, the relationship with medication became one of

reliance and patients explained that unexpected and unplanned circumstances could cause panic attacks:

*“As long as I have got enough inhalers I am alright. I mean if I go out, I wouldn’t tell the doctor this, but I do like to have two. One in my handbag because I think if I got robbed then, you know? If somebody managed to get my handbag then I have to have one in my pocket... I think it is unlikely that both things will go.”*

#### *5.4.4.1.3 Panic attacks as life changing*

##### **5.4.4.1.3.1 Panic attacks are traumatic experiences**

This organising theme relates to the life changing nature of previous panic attacks. Participants recalled their previous episodes of panic as significant and traumatic life events. Episodes of panic were seen as particularly isolating experiences which were characterised by escalating fear:

*“I was panting. It wouldn’t calm down and your heart is bursting because it can’t keep up with the breathing... it gets more and more frightening... this time I was on my own... I was thinking “there is no way out from this, I can’t even crawl.”*

Participants also experienced claustrophobic sensations such as feeling trapped or smothered that were often described in relation to their ability to breathe:

*“It is as though I am sat there and the room is being sealed off completely, as if no air is getting in. The windows and doors would be open but no air is getting in. It’s*

*like the walls are closing in and the closer they get the less you can breathe. It's like it's closing in. And that's how it starts."*

Some panic attacks were perceived as near death experiences that there was little chance of overcoming. Participants recalled their experiences with great clarity and acceptance of their fate. In such cases, there was little desire to fight back:

*"You just think you are going to die, and you just think you would be better just dying and not doing anything about it."*

#### **5.4.4.1.3.2 Panic attacks have a lasting impact**

The traumatic nature of panic episodes had a lasting effect in which participants had an underlying fear of experiencing similar events. The fear and memories of having a panic attack acted as a trigger for further anxiety in some cases:

*"And those panic attacks are always on my mind. They are not very nice believe me. So sometimes, I worry about these things, and sometimes the worry causes your breathing to go bad."*

Participants experienced meta-worry (worry about worry) which sometimes led to further anxiety and panic attacks. Fear of experiencing a panic attack was also seen as disabling. For some participants the combination of previous traumatic experiences and the fear of another episode impacted on daily life:



*"I found panicking and being out of breath when I was outside very embarrassing and in the end I would rather stop in and not put myself in that situation. Now I have basically stopped doing everything."*

Fear of anxiety caused some participants to become housebound. For one person, the fear of experiencing a panic attack was particularly debilitating:

*"I have been in a situation where at bedtime I won't go upstairs. I have literally stayed all night in the armchair because I have been too frightened to go up the stairs in case I get one of these panic attacks."*

#### **5.4.4.2 Content analysis of anxiety symptoms**

The participants in this study reported a range of somatic, cognitive and behavioural anxiety symptoms. As expected, somatic symptoms were common, with all but one participant reflecting upon physical anxiety symptoms. The most common somatic symptoms were breathlessness, heart palpitations and sweating, affecting 86%, 43% and 36% of participants respectively (see Table 5.5).

Table 5.5: Frequency of somatic anxiety symptoms described by participants in Phase1.2

Somatic anxiety symptoms	Number of patients experiencing symptom n (%)*
Breathless	12 (86)
Heart palpitations	6 (43)
Sweating	5 (36)
Feeling smothered	3 (22)
Sleep problems	3 (22)
Shaking	2 (14)
Urinary incontinence	2 (14)
Tingling	2 (14)
Hot flushes	2 (14)
Unable to move	2 (14)
Tiredness	1 (7)
Chest tightness	1 (7)
Butterflies in the stomach	1 (7)

\*Please note that several patients reported more than one symptom

Mapping of the non-somatic anxiety symptoms revealed that there was a high level of convergence between the cognitive and behavioural symptom themes found in the extant scale review and the anxiety symptoms reported by interview participants (see Table 5.6). Participants described symptoms which related to all 12 of the themes identified during the literature review (Phase1.1).

Table 5.6: Comparison of themes between Phase 1.1 and 1.2

Theme from literature review	Number of scales containing theme n (%)	Symptoms from interview	Number of participants experiencing symptom n (%)
Nervousness	8 (57)	Feeling nervous	3 (22)
Tenseness or restlessness	8 (57)	Feeling frustrated	7 (50)
		Experiencing nagging thoughts	
Irritability	4 (29)	Feeling irritable	6 (43)
		Getting easily annoyed	
Inability to relax	8 (57)	Feeling unable to relax	8 (57)
Difficulty concentrating	3 (22)	Feeling unable to concentrate when needed	2 (14)
Fear	11 (79)	Feelings of fear, terror or impending danger	11 (79)
Emotional	4 (29)	Becoming easily upset	8 (57)
		Not being able to control emotions	
General worry	11 (79)	Feeling generally worried	10 (71)
General anxiousness	6 (43)	Feeling generally anxious	6 (43)
Panic	4 (29)	Experiencing episodes of sudden panic or fear	12 (86)
Fear of losing control	4 (29)	Experiencing feelings of potentially losing control	2 (14)
Avoiding anxiety inducing situations	1 (7)	Avoiding situations that might lead to anxiety or panic	6 (43)
<b>Additional themes</b>			
Anticipatory worry		Worry about everyday activities	5 (36)
Anticipatory panic		Feeling anxious about future panic attacks	6 (43)

Symptoms relating to panic and fear were common among the interview participants. Eighty six per cent of participants reported symptoms of panic and 79% of participants reported experiencing feelings of intense fear or impending danger. Although fear was a common symptom in extant scales, panic as a symptom was only identified by three of the 13 scales.

Behavioural anxiety symptoms such as avoiding situations that cause elevated anxiety is an aspect of anxiety that is not covered in the majority of extant scales. However, six of the participants in the current study report this as a symptom of their anxiety experience. In contrast, nervousness was mentioned by three of the participants (22%), yet this was a core anxiety symptom in over 60% of extant scales.

Other symptoms which were common among participants include general worry, difficulty relaxing, feeling frustrated and getting emotional easily. With the exception of emotionality, these cognitive symptoms of anxiety were found in at least half of the extant scales reviewed.

Table 5.7 presents example quotes from the interviews that relate to the symptom themes identified from the literature review.

Table 5.7: Example quotes from Phase 1.2 interviews

Theme	Example quote
Nervousness	<i>"I was so nervous and shaky"</i>
Tenseness or restlessness	<i>"The COPD can trigger off the anxiety ... because you get yourself wound up."</i> <i>"It is very weird and a very tense feeling."</i>
Irritability	<i>"I am just so bloody useless and frustrated. I am annoyed with myself."</i> <i>"It is just that you are annoyed with yourself."</i>
Inability to relax	<i>"I plan something in my head ... I start to worry about it and it would cause a little bit of anxiety, you know?"</i>
Difficulty concentrating	<i>"You can't concentrate. When I am anxious I can't concentrate and I like reading and everything but you can't concentrate on anything."</i> <i>"I like to read books but I just can't concentrate."</i>
Fear	<i>"Oh I have never felt anything like it at all. I don't know, it was frightening, really, really frightening."</i> <i>"Because I would be frightened to death..."</i>
Emotional	<i>"Things upset you like that. It can be something trivial sometimes that triggers it off."</i> <i>"And you can get yourself worked up over things."</i> <i>"I would have got all worked up and then I would have got anxious and then the breathing starts."</i> <i>"And you are getting yourself so worked up about things."</i> <i>"Things upset you and things like that. It can be something trivial sometimes that can trigger it off."</i>
General worry	<i>"I am worried at the moment because I am thinking 'am I going to get back to where I was 6 or 8 months ago?' And that is an underlying worry at the moment."</i> <i>"Yeah I wonder and I worry about where I am going to be. About what the family would do if anything happened. I always worry what is going to happen. And I have thought like that for a while now."</i> <i>"I have worried about what is going to</i>

Theme	Example quote
General anxiety	<p><i>happen."</i></p> <p><i>"I could not get to sleep. And that gets you a bit anxious, especially when my husband needs to sleep."</i></p> <p><i>"And you do something and then think I can't do that, and it is like a flashback, and you think oh god and that's that thing when you start to feel a bit anxious."</i></p>
Panic	<p><i>"If I had been out and got dropped off at the gate... I could be in a panic attack before I actually got to the front door."</i></p> <p><i>"The more I gasped the more panicky I got and the worse it got."</i></p> <p><i>"I did get quite panicky then because I was thinking what is going to happen?"</i></p>
Fear of losing control	<p><i>"The anxiety feeds the fear and then you are thinking to yourself – I have got to control this, I have got to control it. And I used to feel out of control."</i></p> <p><i>"Everything was spiralling out of control."</i></p> <p><i>"A panic attack is very similar to over doing it but you just can't control it. You can't breathe and you can't control it."</i></p>
Avoidance of anxiety-inducing situations	<p><i>"I seem to get out of breath. I think 'oh it's coming on again', so I stop doing it and I wonder sometimes if I should carry on doing it."</i></p> <p><i>"I found being out of breath when I was outside very embarrassing and in the end I would rather stop in and not put myself in that situation. Now I have basically stopped doing everything."</i></p>

In addition to the 12 symptom themes that were previously identified in Phase1.1, the interviews revealed two further domains of non-somatic anxiety that are not covered in extant scales: *anticipatory worry* and *anticipatory panic*.

#### 5.4.4.2.1 Anticipatory worry

The first domain identified through interviews relates to worries about everyday tasks, such as going shopping or visiting a friend. This was labelled as *anticipatory worry*. Participants described their fears and worries about participating in a range of everyday activities; often well in advance of the event:

*"Yeah because you are thinking all the time. And it spoils it because you are worrying about things before you have actually got there."*

The excessive anticipatory worry that participants described appeared to be closely related to a fear of becoming breathless through overexertion. For example, one participant described a situation where they became anxious at the thought that they might have to walk to a restaurant or up a flight of stairs:

*"Also, I would start to worry about doing things. Say I were going out on Saturday night, I would be worrying about it now... You would be worrying about whether there would be anywhere to park near the entrance, so you didn't have to walk. You would be worrying if it were upstairs."*

For some patients, the anticipatory worry about activities and the prospect of becoming breathless caused them to experience a panic attack:

*"I get them [panic attacks] thinking what could happen I suppose, like if I was walking up hills and things."*

Other participants experienced anticipatory worry in relation to their medications:

*"...and now when we are going out it is like 'have you got your inhaler? Have you taken your tablets? Have you got your spare tablets in case you are ill while we are away?' It is a totally different thing, you can't just think 'let's go here and get up and go', you have got to think 'have I got my inhaler with me? Have I got these? Have I got my tablets?'"*

#### *5.4.4.2.2 Anticipatory panic*

The second domain that was identified through the qualitative interviews was the notion of *anticipatory panic*, or a worry about experiencing future panic attacks. Several participants reported experiencing flashbacks of previous panic attacks, which led to an underlying worry about experiencing future panic:

*"... you start to get flashbacks and worry."*

*"...they [panic attacks] are always on my mind. They are not very nice believe me. So sometimes I worry about these things."*



Panic attacks were associated with intense fear, near-death experiences, and were perceived as serious life events. As a result, participants explained how these life-changing events caused considerable distress, which affected daily life:

*“Well they [panic attacks] are such a big part of your life... Everything revolves around it... It is awful. It is the most horrible, horrible place to be.”*

*“I have been in a situation where at bedtime I won’t go upstairs. I have literally stayed all night in the armchair because I have been too frightened to go up the stairs in case I got one of these panic attacks.”*

## 5.5 CONCLUSIONS

The results from these two studies provide an insight into key symptoms of anxiety from both emic and etic perspectives. In general, the symptoms of anxiety experienced by interview participants closely mirror those assessed in extant anxiety scales. However, two additional symptoms of *anticipatory anxiety* and *anticipatory panic* appear to be relevant aspects of anxiety among patients with COPD. Furthermore, *behavioural anxiety* in the form of *avoidance of anxiety-inducing situations* is another aspect of the anxiety construct which may be pertinent to patients with COPD and yet is not included within the majority of extant scales.

Although interview participants experienced the majority of symptoms found in the scale review, it is evident that patients with COPD experience panic and worry more than some other symptoms of anxiety, such as difficulty in concentrating or nervousness. The review of extant scales suggests that not all anxiety scales cover aspects of panic, yet this appears to be particularly prevalent among patients with COPD. Almost all scales, on the other hand, cover worry as an aspect of anxiety.

The experiences of participants in the present study indicate that anxiety, and particularly panic attacks, are distressing experiences that have a considerable impact upon daily life. In addition, their accounts suggest that although patients with COPD experience a high incidence of somatic anxiety symptoms such as breathlessness and palpitations, these are readily confused with symptoms of respiratory disease and the side effects of medication. This finding supports the notion that non-somatic items may be particularly useful in identifying and detecting anxiety in patients with COPD, and lends support to the development of a non-somatic anxiety scale.

## 5.6 DEVELOPMENT OF POTENTIAL SCALE ITEMS

The results from emic and etic perspectives acted as a basis for the item writing process. Therefore, the 14 symptom themes that were identified were used as a guide for item content. In addition to item content and wording, three important decisions guided the development of the draft items:

- 1) the overarching syntax of the scale
- 2) the response format
- 3) The timeframe of the response

The following section outlines the decisions that guided this process.

#### *5.5.1 ITEM FORMAT*

It was decided that in order to minimise cognitive load and erroneous responding, each statement should contain the same sentence stem (Michalak & Murray, 2010). Therefore, each statement began with the sentence stem – *‘I have...’*

A pool of items was written to cover the 14 symptom themes that were identified previously (see section 5.4.4.2). Where possible, the words that participants used to describe their symptoms were incorporated into the statements. For example, words such as *‘wound-up’*, *‘annoyed’*, *‘worked-up’* and *‘panicky’* were used in the new items.

A relatively small pool of items was written (Table 5.8) as it was deemed important to minimise participant burden, especially in those with acute respiratory or anxiety symptoms. Therefore, for most themes a single item was written. In keeping with the majority of items from extant scales, a decision was made by the author and supervisory team that items would be worded in a negative direction. However, it was decided that one positively worded item

would be included to explore acquiescence bias. Hence, for the theme ‘inability to relax,’ two items were written.

Table 5.8: Items developed for new scale

Themes from literature review	Item number	Item wording	Associated DSM-IV-TR anxiety diagnosis
Nervousness	13	‘I have felt nervous or on-edge’	GAD
Tenseness or restlessness	1	‘I have felt tense, restless or wound-up’	GAD
Irritability	2	‘I have felt irritable and/or easily annoyed’	GAD
Inability to relax	9	‘I have found it hard to relax’	GAD
	16	‘I have felt relaxed and in control’	GAD
Difficulty concentrating	3	‘I have found it difficult to concentrate on things, such as watching TV or reading’	GAD
Fear	12	‘I have had thoughts that something bad might happen’	PD
Emotional	6	‘I have felt worked-up and/or upset’	GAD
General worry	4	‘I have had worrying thoughts going through my mind’	GAD
General anxiety	11	‘I have felt generally anxious’	GAD
Panic	10	‘I have had sudden and intense feelings of fear and/or panic’	PD
	5	‘I have felt very frightened or panicky’	PD
Fear of losing control	7	‘I have had a fear of losing control or falling apart’	PD
Avoidance of anxiety-inducing situations	14	‘I have avoided situations that I felt might lead me to panic’	PD
Anticipatory anxiety	15	‘I have worried about doing everyday tasks, such as going shopping or visiting a friend’	GAD
Anticipatory panic	8	‘I have worried about experiencing panic’	PD

DSM-IV-TR, Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition-Text Revision; GAD, generalised anxiety disorder; PD, panic disorder

As feelings of panic were the most frequently cited symptom by patients, a decision was made to include two items that were designed to reflect this symptom theme. One item – *‘I have had sudden and intense feelings of fear and/or panic’* was written to reflect PAs, whereas another item – *‘I have felt very frightened or panicky’* was written to reflect a state of hyper-arousal, and also to closely mirror the words used by patients to describe their experience of panic. Six of the items reflect the criteria for a DSM-IV-TR diagnosis for PD, whilst the other 10 reflect key symptoms considered in a GAD diagnosis (APA, 2000).

The reading age of the new items was examined to determine if items needed re-wording. Items had a Flesch-Kincaid reading level of grade 4.9. This is below the minimum reading level of grade 5 that DeVellis (2003) advises for writing scales for the adult population. In the UK, grade 5 is the equivalent of Year 6, with pupils aged between 10-11 years old.

### 5.5.2 RESPONSE FORMAT

The choice of response format was guided by the decision that the scale should assess the severity of markers of anxiety. Therefore, a response that was anchored between experiencing a symptom that occurred almost all of the time, to not at all seemed prudent. A 4-point Likert-type response format was chosen as it is the best understood response format in psychology, and is psychometrically powerful and efficient (Carifio & Perla, 2008). In addition, this response format is the most commonly used format in existing anxiety scales

(see Table 5.1). Longer alternatives would have the advantage of being more continuous levels of measurement, but would add to the response burden.

All statements, therefore, had four possible responses that were scored from 0-

3. These were as follows:

- Not at all (0)
- Occasionally (1)
- Frequently (2)
- Almost all of the time (3)

### *5.5.3 TIMEFRAME*

A decision was made to incorporate a timeframe of 2 weeks because it is intuitively familiar, requires minimal recall and will therefore minimise the cognitive load (Michalak & Murray, 2010). In addition, this is a similar timeframe to that used in other psychiatric instruments such as the GAD-7 and the Patient Health Questionnaire (PHQ; Spitzer et al., 1999) so allows direct comparison with these scales. Finally, the review of extant scales suggests that a timeframe of between 1 week and 1 month is optimal.

The wording of the scale read as follows:

‘Please think back over the **past 2 weeks** and mark (X) in the box that best describes how you have felt. Be sure to only select one response for each item.’

#### 5.5.4 COMPLETION AND LAYOUT

After consulting with an expert reference group (ERG) that included members of the Breathe Easy network (n = 4), two physiotherapists, two respiratory nurse specialists and a geriatric psychiatrist, it was decided that due to the decline in cognitive performance and visual acuity that occurs in older patients with COPD (e.g., Hung et al., 2009; Sjöstrand et al., 2011), items should be easy to read, and large spaces should be provided for respondents to mark. Therefore, each item was designed to have its own shaded area with four clear response sections (see Figure 5.3).

I have felt tense, restless or wound-up			
Not at all	Occasionally	Frequently	Almost all of the time

Figure 5.3: Example item from the 16-item scale

#### 5.5.5 PILOTING

Once the items had been developed and the final scale had been designed, the 16-item scale was piloted with participants from the ERG to test for usability. It was also given to the clinicians from the ERG to test for face and content validity. No further amendments were advised.

## 5.7 SUMMARY OF CHAPTER 5

This chapter described the mixed methods approach to scale development in which emic and etic perspectives were integrated to develop 16 novel anxiety items. These reflect the experiences of patients with COPD and are guided by the words used by participants to describe their anxiety. The items generated in Phase 1 are, therefore, grounded in the experiences of patients with COPD and relevant to this clinical population.

The qualitative interviews also allowed an in-depth exploration of the experience of anxiety from the perspectives of patients with COPD. A thematic network analysis approach identified three thematic networks, each with a global theme: relationships with breathing, fighting for control, and panic attacks as life changing.

The following chapter will describe the process of refining the pool of scale items into a reliable and valid scale through quantitative analysis based on data from clinical samples of patients with COPD.



## Chapter 6 : PHASES 2 & 3 – SCALE REFINEMENT AND VALIDATION

### 6.1 INTRODUCTION

In the previous chapter (Chapter 5), the development of an initial pool of items using a mixed methods approach was described. In this chapter, the quantitative processes relating to the reduction of the initial pool of scale items into an internally consistent and valid scale are discussed. The chapter contains two phases of work: Phase 2 and Phase 3. In Phase 2, the 16 items established in the item development phase were reduced, using classical test approaches, to produce a shortened scale (the AIR) with strong internal consistency and a clear factorial structure. In Phase 3, the psychometric properties and clinical utility of the final 10-item AIR were established.

### 6.2 CHAPTER 6 AIMS

1. To refine items developed in Phase 1 into a short, novel, user-friendly and unidimensional anxiety scale that assesses markers of anxiety and screens for anxiety disorders in patients with COPD.
2. To establish psychometric properties, perform initial validation and establish clinical screening utility of the new scale in a sample of patients with stable COPD.

## 6.3 PHASE 2: SCALE REFINEMENT

### *6.3.1 PHASE 2 AIM*

To reduce the initial 16-item AIR into a scale with high internal consistency and a clear factor structure through scale analysis and EFA procedures.

### *6.3.2 METHOD*

#### **6.3.2.1 Procedure**

Participants completed the draft AIR (see Appendix 7) which contained the 16 items developed in Phase 1. Basic demographic data were also recorded.

#### **6.3.2.2 Sample**

The sample consisted of both inpatients and outpatients with COPD.

Outpatients were recruited through convenience sampling by the author from two localities. The first location was four PR groups running within the Pennine Acute Hospital NHS trust. The second location was four Breathe Easy groups in the Greater Manchester area (Bury, Newton Heath, Oldham, and Tameside and Glossop). Inpatients were recruited by the author, or with the help of a Trust research assistant, from an acute medical ward at Tameside Hospital Foundation Trust in Greater Manchester.

Patients were eligible for inclusion if they were  $\geq 40$  years of age and had a documented primary diagnosis of COPD (defined by spirometry:  $FEV_1 < 80\%$  of predicted and  $FEV_1/FVC < 70\%$  predicted; NICE, 2010). Inpatients were eligible for inclusion if they had been admitted to hospital due to AECOPD.

Patients were excluded if they had a documented cognitive impairment e.g., Mini Mental State Examination Score  $< 25$  (Iliffe et al., 1990), had another primary diagnosis e.g., severe chronic heart failure or unstable angina, or did not understand written English.

The author approached all eligible outpatients either at the PR groups or at monthly Breathe Easy group meetings. Eligible participants were given information packs which contained a Participant Information Sheet (see Appendix 8) and an example Informed Consent Form (see Appendix 9). Eligible inpatients were given the same research information packs shortly after admission to hospital, when their condition had stabilised. All potential participants were given 24 hours to consider their involvement in the study and were encouraged to ask for clarification if there was any information they did not understand.

#### **6.3.2.3 Data analysis**

Data were analysed using item and factor analysis with Statistical Package for Social Sciences (SPSS; version 19) in order to: (a) refine the item pool and establish initial internal reliability, and (b) assess factorial structure. A

constructive approach to item reduction was used to remove items based on a number of criteria. There are no strict criteria guiding the removal of items but based on the recommendations of other scale developers (Al-Shair et al., 2009; Bova et al., 2006; Costello & Osbourne, 2005; DeVellis, 2003; Fabrigar et al., 1999), items were removed for the following reasons:

1. They had an item-total correlation of  $<.55$ .
2. They showed redundancy of measurement defined by a high correlation ( $r \geq .9$ ) with another item.
3. They had a squared multiple correlation ( $r^2$  coefficient) of  $<.5$  or  $>.9$ .
4. They had “floor” or “ceiling” effects. This was defined as items that were mostly answered with “*Not at all*” or “*Almost all of the time*”.
5. They increased internal consistency (Cronbach’s  $\alpha$ ) if removed.
6. Their communalities (or shared variance) were  $<.5$ .

After the final item selection, remaining items were subjected to ML EFA. Prior to testing, the suitability of the data for ML EFA was assessed using three different tests:

1. KMO value. This tests whether the data is likely to factor well. A value  $\geq .7$  is considered to be good (Hutcheson & Sofroniou, 1999).
2. Bartlett’s test of sphericity. A significant value disaffirms the null hypothesis that the correlation matrix is an identity matrix i.e., that there is no relationship between the items (Field, 2005).

3. Examining the correlation matrix for the presence of multiple coefficients (Williams et al., 2010).

Extraction of factors was based on Kaiser's criterion for an Eigen value of >1 and Cattell's scree test (Field, 2005). Internal consistency was assessed using Cronbach's  $\alpha$  and Guttman's split-half coefficient.

Normal distribution of the final 10-item AIR was assessed by Shapiro-Wilk goodness of fit test. Non-normally distributed data was transformed using log to base 10 (Field, 2005). The data could not be transformed to normal distribution and were therefore analysed using a non-parametric equivalent of the t-test: the Mann-Whitney U test. Means of total scores were compared according to patient recruitment site (outpatient vs. inpatient) and sex using Chi-square test. Significance was set at  $p < 0.05$ .

### *6.3.3 RESULTS*

#### **6.3.3.1 Sample characteristics**

In all, 156 patients with COPD were invited to participate in this study; 91 inpatients and 65 outpatients. A total of 88 patients participated in this study; 33 (37.5%) outpatients and 55 (62.5%) inpatients. This resulted in a response rate of 56.4% overall (60.4% for inpatients and 53.8% for outpatients). The mean (SD) age of the total sample was 70.6 ( $\pm 11.9$ ) years (66.8 ( $\pm 9.1$ ) years for outpatients and 74.1 ( $\pm 8.1$ ) years for inpatients). Thirty-two (36.4%) of the sample were male (10 (30.3%) outpatients and 22 (40.0%) inpatients).



### 6.3.3.1 Item reduction

Table 6.1 shows mean (SD) values and range of scores for all 16 items. All items had reasonable means that were close to mid-values. Using constructive steps, a total of six items were excluded from the initial 16 items:

First, item 16 *"I have felt relaxed and in control"* was removed for having an item-total correlation  $<.55$  and a  $r^2$  coefficient of  $<.5$ . Second, items 2 *"I have felt irritable and/or easily annoyed"*, 14 *"I have avoided situations that I felt might lead me to panic"*, 15 *"I have worried about everyday tasks, such as going shopping or visiting a friend"*, and 3 *"I have found it difficult to concentrate on things, such as watching TV or reading"* were removed as they did not contribute strongly to internal consistency (their removal increased Cronbach's  $\alpha$ ) and had communalities  $<.5$ . Finally, item 1 *"I have felt tense, restless or wound-up"* was removed as its removal improved internal consistency, it had a communality of  $<.5$ , and had a borderline  $r^2$  coefficient value ( $r^2=.51$ ). No items demonstrated floor or ceiling effects.

Following these steps, a 10-item version of the AIR was produced (see Appendix 10). Assessment of the scale's reliability found excellent internal consistency (Cronbach's  $\alpha = 0.95$ ; 95% CI: 0.94-0.97) and split-half reliability (Guttman's coefficient = 0.95).

Table 6.1: Phase 2 item scores

	Item	Mean	SD	Range
1	I have felt tense, restless or wound-up	1.49	0.97	0-3
2	I have felt irritable and/or easily annoyed	1.28	0.95	0-3
3	I have found it difficult to concentrate on things, such as watching TV or reading	1.24	1.07	0-3
4	I have had worrying thoughts going through my mind	1.21	1.02	0-3
5	I have felt very frightened or panicky	1.01	0.95	0-3
6	I have felt worked-up and/or upset	1.23	0.89	0-3
7	I have had a fear of losing control and/or falling apart	0.85	0.95	0-3
8	I have worried about experiencing panic	0.86	0.95	0-3
9	I have found it hard to relax	1.52	1.00	0-3
10	I have had sudden and intense feelings of fear and/or panic	0.91	0.94	0-3
11	I have felt generally anxious	1.23	0.86	0-3
12	I have had thoughts that something bad might happen	1.07	0.91	0-3
13	I have felt nervous or on-edge	1.21	0.89	0-3
14	I have avoided situations that I felt might lead me to panic	1.18	1.01	0-3
15	I have worried about doing everyday tasks, such as going shopping or visiting a friend	1.16	1.08	0-3
16	I have felt relaxed and in control	1.52	1.02	0-3

### 6.3.3.2 Factor analysis

Prior to testing, the suitability of the data for EFA was confirmed. The KMO value was 0.92, considerably higher than the minimum recommended value (Hutcheson & Sofroniou, 1999), and Bartlett's test of sphericity was significant ( $\chi^2=1060.61$ ,  $p<0.001$ ). Finally, inspection of the correlation matrix revealed numerous coefficients.



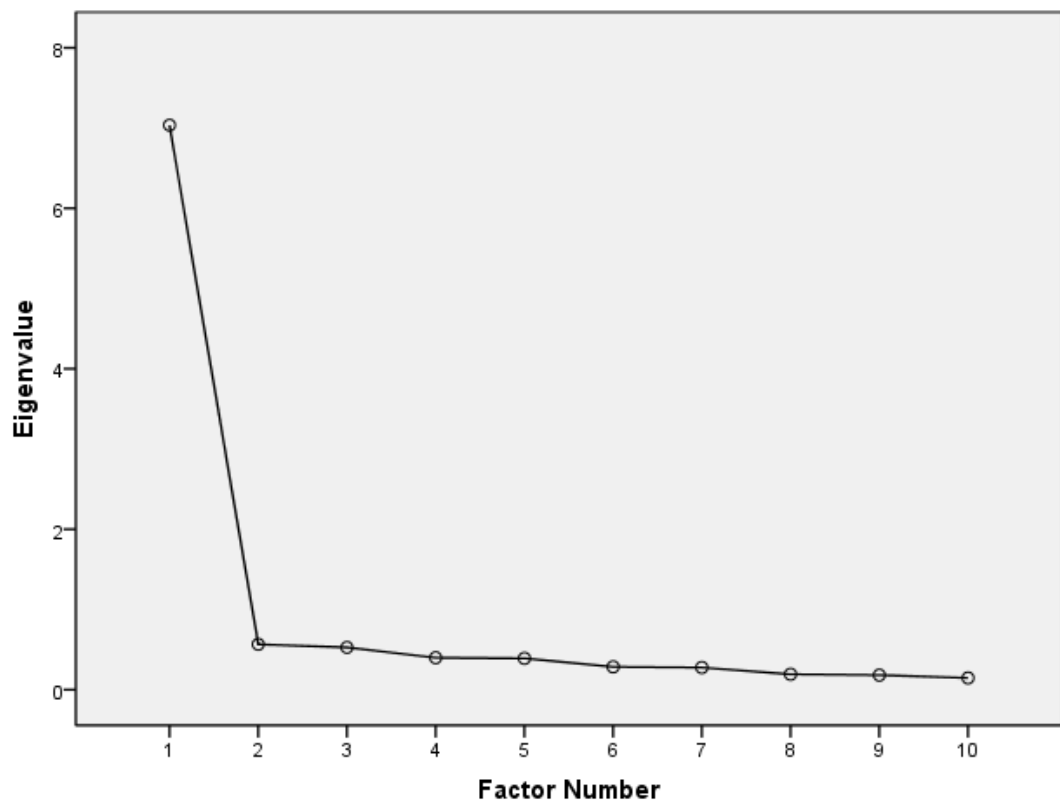


Figure 6.1: Scree plot for 10-item AIR

EFA revealed a single factor (*'anxiety'*) with an eigenvalue of 7.04, which accounted for 67.15% of variance. Catell's scree plot (Figure 6.1) supported the existence of a single factor, demonstrating a clear point of inflexion at the second factor. The presence of a single factor dictated that no rotation was required. Factor loadings were high across all 10 items with a mean loading of  $0.82 \pm 0.05$  (see Table 6.2). Communalities varied from 0.50-0.77 with a mean value of  $0.67 \pm 0.09$ .

Table 6.2: Factor loadings and communality values for final 10-item AIR

Original item number	New item number	Item	Communality	Factor 1 loading
4	1	I have had worrying thoughts going through my mind	0.65	0.81
5	2	I have felt very frightened or panicky	0.70	0.84
6	3	I have felt worked-up and/or upset	0.56	0.75
7	4	I have had a fear of losing control and/or falling apart	0.65	0.81
8	5	I have worried about experiencing panic	0.77	0.88
9	6	I have found it hard to relax	0.50	0.71
10	7	I have had sudden and intense feelings of fear and/or panic	0.74	0.86
11	8	I have felt generally anxious	0.70	0.84
12	9	I have felt nervous or on-edge	0.77	0.88
13	10	I have had thoughts that something bad might happen	0.67	0.82
<b>Mean (SD)</b>			<b>0.67 ± 0.09</b>	<b>0.82 ± 0.05</b>

Scores for the 10-item AIR ranged from 0-30 (mean (SD) = 11 ± 7.8; median = 10) and were positively skewed (Shapiro-Wilk test,  $p=0.001$ ) (see Figure 6.2).

There was no difference between median total scores for patients from inpatient settings compared with outpatients ( $U = 766$ ,  $p= 0.22$ ). Likewise, no difference was found between median scores for males compared to females ( $U = 865$ ,  $p=0.79$ ).

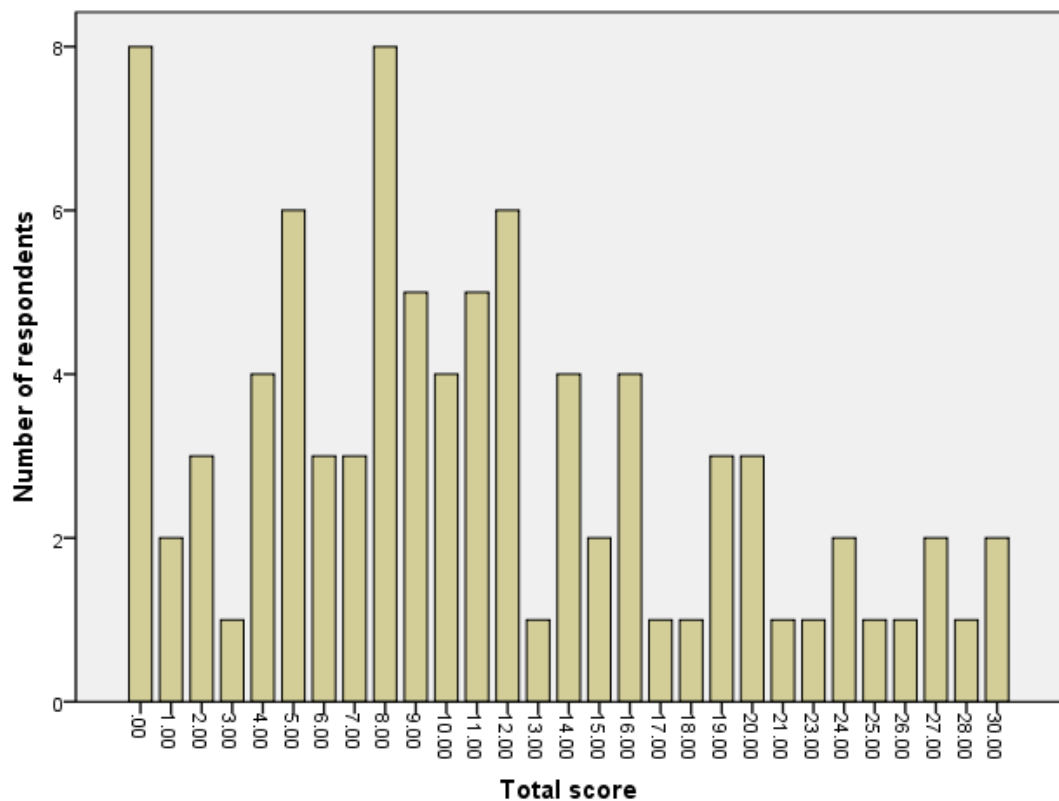


Figure 6.2: Distribution of scores for 10-item AIR

#### 6.3.4 PILOTING OF 10-ITEM AIR

Four patients with COPD who were recruited from the Tameside and Glossop Breathe Easy group were asked to complete the 10-item AIR prior to filling out a feedback form which rated the AIR on ease of completion, content and clarity (see Appendix 11). Participants were asked to rate each aspect on a scale of 0-10, with ten being the highest rating and zero the lowest. They were also encouraged to leave comments if they wished. All participants rated the AIR as easy to complete (mean score of 10). The mean score for content was 8.8. All four patients scored the AIR a 10 for clarity.

Participants were generally positive about the AIR. Positive comments included: *“Really simple and straightforward”* (Participant 1), *“I found it very easy to read, even without my glasses”* (Participant 4). One participant commented that the AIR could be longer to capture more symptoms: *“It was short. Perhaps you could add some more questions in as I doubt it would make much difference in how long it would take to complete it”* (Participant 2). On average, the 10-item AIR took 95 seconds to complete.

### 6.3.5 KEY FINDINGS FROM PHASE 2

In Phase 2 of the research the initial 16-item AIR was reduced to a 10-item version of the AIR using constructive steps based on scale and factor analysis. The final 10-item AIR demonstrated excellent internal consistency and a clear single-factor structure. Piloting of the AIR verified that the scale is easy to understand and quick to complete.

## 6.4 PHASE 3: SCALE VALIDATION

### 6.4.1 PHASE 3 AIMS

- To examine the psychometric properties of the AIR in a sample of patients with stable COPD.
- To explore the ability of the AIR to screen for anxiety disorders and to establish a cut-off score for the scale’s clinical utility as a screening tool.

- To explore the prevalence of psychiatric diagnoses among a sample of stable COPD outpatients.
- To identify clinical characteristics of patients with clinical anxiety disorders.

#### 6.4.2 HYPOTHESES

In order to establish the validity of the AIR, a number of *a priori* hypotheses were generated. The hypotheses for Phase 3 of the research are as follows:

- To establish convergent validity it is hypothesised that the AIR will demonstrate strong correlation with the HADS-A. It is also expected that the AIR will correlate (but to a lesser extent) with the HADS-D. This will reflect the general negative affect which occurs in those patients experiencing anxious and depressive symptoms (McDowell, 2006).
- To establish known groups validity, it is hypothesised that those patients with COPD and a clinical anxiety disorder will have significantly higher total AIR scores than those without an anxiety disorder.
- To establish construct validity it is hypothesised that a single factor model will provide the best data fit through CFA
- To establish temporal stability it is hypothesised that scores on the AIR will remain stable over a two-week period.

### *6.4.3 METHOD*

#### **6.4.3.1 Procedure**

Participants completed a battery of self-report instruments, including the AIR; the COPD Assessment Tool (CAT); the HADS; the Manchester Respiratory Activities of Daily Living questionnaire (MRADL), and the PHQ, and were also asked to provide basic demographic details including age, smoking history etc. Severity of COPD was established through lung function testing. Participants were then sent the same self-report instruments one week later and asked to return the completed measures by pre-paid post. Those participants who consented also underwent a structured psychiatric interview (the Mini-International Neuropsychiatric Interview; MINI) at a later date in order to establish a 'gold standard' diagnosis of psychiatric disorders.

#### **6.4.3.2 Sample**

The sample consisted of outpatients with COPD who were recruited from two sources: (1) patients attending PR classes running within the Pennine Acute Hospital NHS Trust, and (2) community-based patients who were on the patient list of the Pennine Acute Hospital NHS Trust Acute Respiratory Assessment Service (ARAS); a community nursing service for patients with COPD.

1. Patients with COPD who were attending the PR classes were approached by the author during the educational component of the class. All eligible patients were given an information pack that contained a Participant

Information Sheet (see Appendix 12) and an example Informed Consent Form (see Appendix 13). Potential participants were given 48 hours to consider their involvement in the study and were encouraged to ask for clarification from the author on any information they did not understand.

Data were collected during the following PR class (usually between 3 and 5 days later) where participants were also required to give written informed consent.

2. All patients with COPD who were under ARAS care were sent a research invitation pack by post. The invitation pack contained a Research Invitation Letter (see Appendix 14), Participant Information Sheet and an example Informed Consent Form. A detachable 'interest' form was produced as part of the Research Invitation Letter. Patients who were interested in participating were asked to complete the form and return by pre-paid post.

All patients who expressed an interest in participating in the research were contacted by the author in order to answer any questions and to arrange a home visit for data collection. During the home visit, the author obtained informed consent and collected the relevant data (outcome measures and demographic data).

One week later, all participants were sent a follow-up letter (see Appendix 15) and the same self-report instruments by post. Participants were requested to complete the self-report instruments on delivery and to return them by pre-paid post. The follow-up letter also asked participants to indicate whether there had been any major change in their health status since their initial participation.

Those participants who consented to psychiatric interview were visited at a later date by a second researcher (an expert in psychiatric disorders and COPD) who was blinded to the previous results. The diagnostic interviews were conducted according to the MINI structured format (Sheehan et al., 1998) and, typically, lasted 15-30 minutes. Patients also completed the AIR scale prior to psychiatric interview.

Patients were eligible for inclusion if they were  $\geq 40$  years of age, had a documented primary diagnosis of COPD (defined by spirometry:  $FEV_1 < 80\%$  of predicted and  $FEV_1/FVC < 70\%$  predicted; NICE, 2010). They were excluded if they had a documented cognitive impairment e.g., Mini Mental State Examination Score  $< 25$  (Illiffe et al., 1990), had another primary diagnosis e.g., chronic heart failure or unstable angina, or did not understand written English.

### **6.4.3.3 Measurements**

#### *6.4.3.3.1 COPD Assessment Test (CAT)*

The CAT (Jones et al., 2009b) is a disease specific HRQoL tool that measures the impact of COPD on a patient's life (see Appendix 16). The CAT consists of eight



items, with each item containing two statements describing the best and worst scenarios. Patients are asked to rate on a scale of 0-5 where they believe they are on the scale. Scores range from 0-40 with a higher score indicating worse health status. Initial findings indicate that the CAT is reliable (Cronbach's  $\alpha=0.88$ ), valid and sensitive to changes in health status (Jones et al., 2009a; Jones et al., 2009b; Jones et al., 2012).

#### *6.4.3.3.2 Hospital Anxiety and Depression Scale (HADS)*

The HADS (Zigmond and Snaith, 1983) is described in detail earlier in this thesis (see section 2.8.1.4). The HADS (see Appendix 6) was chosen for this study as it provides a recognised marker of anxiety and depression symptom severity and is recommended internationally for clinical use in patients with COPD (GOLD, 2011; Maurer, 2008). The HADS has good reliability and validity and is the most common marker of anxiety and depression in COPD-related research.

#### *6.4.3.3.3 Manchester Respiratory Activities of Daily Living questionnaire (MRADL)*

The MRADL (Yohannes et al., 2000b) is a self-complete respiratory specific activities of daily living (ADL) questionnaire (see Appendix 17). The questionnaire contains 21 items that assess functional ability across four domains: mobility, kitchen activities, domestic activities and leisure activities. Patients are asked to indicate their ability to perform activities across four possible responses: not at all, with help, alone with difficulty, or alone easily. Scores range from 0-21 with a lower score indicating worse functional ability.

The MRADL has good documented reliability (Cronbach's  $\alpha=0.91$ ) and validity (Yohannes et al., 2000b; 2002).

#### *6.4.3.3.4 Patient Health Questionnaire (PHQ) – anxiety screeners*

The PHQ (Spitzer et al., 1999) is a self-report questionnaire which acts as a diagnostic tool for a variety of mental disorders including depressive, anxiety, somatoform, alcohol and eating disorders. The anxiety section of the questionnaire (see Appendix 18) contains two sections that screen for PD and 'other anxiety disorder' (typically GAD). The PHQ is an accurate and valid screening tool for diagnosing anxiety disorders in clinical populations (Spitzer et al., 1999; 2000). Spitzer and colleagues (1999) found that the self-report PHQ was comparable to the Primary Care Evaluation of Mental Disorders (PRIME-MD; Spitzer et al., 1994) diagnostic interview in diagnostic accuracy. Studies exploring the accuracy of the PHQ in detecting anxiety disorders indicate that when compared to a structured psychiatric interview, the PD specific screener has a diagnostic accuracy of 96% in medical patients (Löwe et al., 2003). For detecting any anxiety disorder, the 'other anxiety disorder' component of the PHQ has a diagnostic accuracy of 93% (Diez-Quevedo, 2001).

#### *6.4.3.3.5 The Mini- International Neuropsychiatric Interview (MINI)*

The MINI (Sheehan et al., 1998) is a short, structured diagnostic interview developed for DSM-IV and ICD-10 psychiatric disorders (see Appendix 19). The MINI takes about 15 minutes to complete and has well established validity and reliability (Lecrubier et al., 1997; Sheehan et al., 1998).

#### *6.4.3.3.6 Spirometry*

Spirometry was performed using a Vitalograph 2120 handheld spirometer (Vitalograph, Buckingham, England) according to ATS/ERS Standardisation Guidelines (Miller et al., 2005). COPD severity was classified as mild, moderate, severe or very severe according to GOLD (2011) guidelines (see Table 1.1 in Chapter 1).

#### **6.4.3.4 Data analysis**

##### *6.4.3.4.1 Tests of normality*

All data analyses were performed using SPSS (version 19). Normal distribution was assessed by the Shapiro-Wilk goodness of fit test. Non-normally distributed data were transformed using transformation to base 10 (Field, 2005). Where data could not be transformed, original data were retained and non-parametric statistics were used. AIR score, MRADL score and FEV<sub>1</sub>% predicted were all found to have non-normal distributions (see Appendix 20). Transformation of data was only successful for FEV<sub>1</sub>% predicted and therefore non-parametric statistics were used for analyses involving non-normally distributed variables. Normally distributed variables were analysed using parametric statistical tests e.g., t-test or Chi-square.

Data is presented as mean (SD) for normally distributed data and median (interquartile range; IQR) for non-normally distributed data.

A p-value of 0.05 was selected *a priori* and was used for all analyses.

#### *6.4.3.4.2 Group comparisons*

Kruskall-Wallis H Test, a non-parametric alternative to analysis of variance (ANOVA) was used to evaluate the difference between AIR scores for patients according to GOLD (2011) classification (mild, moderate, severe and very severe) and smoking status (current smoker, previous smoker or never smoked). A Mann-Whitney U test was conducted to compare mean rank AIR scores for patients according to sex.

T-tests for parametric statistics, and Mann-Whitney U tests and Chi-Square tests for non-parametric data were also used to explore any differences in clinical characteristics (e.g., Age, Sex, FEV<sub>1</sub>% predicted, anxiety) between patients who completed follow-up and those who did not.

#### *6.4.3.4.3 Reliability of AIR*

Reliability was calculated for the first completion of the AIR and also for follow-up data. Internal consistency reliability was evaluated using Cronbach's  $\alpha$ , and Guttman's split-half coefficient. Test-retest reliability was calculated using ICC and Bland-Altman mean difference plots (Bland & Altman, 1986).

#### 6.4.3.4.4 Validity

##### 6.4.3.4.4.1 Known groups validity

Known groups validity was calculated by comparing total AIR score between anxiety cases and non-cases using the Mann-Witney U test.

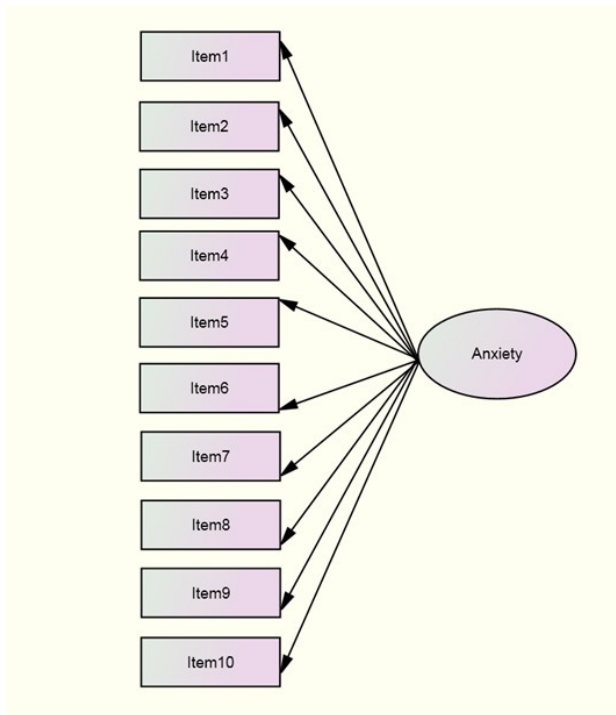
Independent t-tests and Mann-Whitney U tests were carried out on demographic data to compare any differences between anxiety cases and non-cases.

##### 6.4.3.4.4.2 Convergent validity

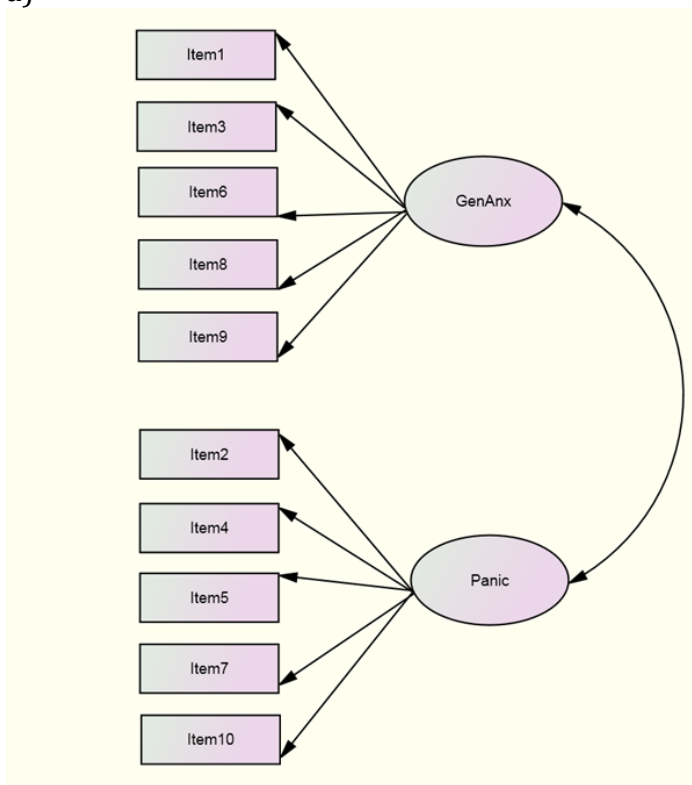
To measure convergent validity the AIR scores were compared to the HADS-A score using Spearman's rho correlation coefficients. The associations between the AIR and the HADS-D, HADS-T, CAT and MRADL were also assessed using Spearman's rho correlation coefficients.

##### 6.4.3.4.4.3 Construct validity

Construct validity was established by conducting CFA to determine the degree of model-fit. All CFAs were undertaken using AMOS (version 19) SEM software. The following models were compared: a single-factor model with one factor of '*anxiety*' (Figure 6.3a) and a two-factor model with two intercorrelated factors of *panic* and *general anxiety* (Figure 6.3b).



a)



b)

Figure 6.3: Two CFA models: a) single-factor model of anxiety, b) two-factor model of general anxiety and panic

Model fit was determined using six indices to empirically evaluate the models. These were the overall model Chi-Square ( $\chi^2$ ); the root mean square error of approximation (RMSEA); the GFI; the standardised root mean square residual (SRMSR); the NNFI or TLI, and the comparative fit index (CFI). Although there are no strict criteria for evaluating these measures, based on current guidelines, model fit was considered acceptable if CFI was 0.90 or greater, if RMSEA was between 0.08 and 0.10, if SRMSR was between 0.08 and 0.05 and if TLI was 0.80 or greater. Good fit was indicated if GFI was 0.90 or greater, CFI and TLI were 0.95 or greater, if RMSEA was less than 0.08, and if SRMSR was less than 0.05. For the overall model  $\chi^2$ , non-significant values indicated a good model fit (Hooper, 2008; Hu & Bentler, 1999; Kline, 2005; MacCallum et al., 1996; Miles & Shevlin, 1998).

Ad hoc improvements to the model were permitted if they fitted within the theoretical framework of the model. These were conducted on the recommendation of modification indices provided by the SEM software.

#### *6.4.3.4.5 Clinical cut-off value*

The sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were calculated for each score on the AIR. Diagnosis according to PHQ screener were used as the criterion standard for the absence or presence of anxiety disorders. In order to determine a cut-off point for clinical anxiety, ROC curves were constructed. ROC curves were also

constructed for the HADS-A to enable direct comparison of the screening properties with the AIR.

In addition, data from the psychiatric interviews were used to further explore ROC and clinical cut-off values. Patients were grouped into cases or non-cases for any clinical anxiety disorder and for specific cases of PD or GAD.



#### *6.4.4 RESULTS*

Figure 6.4 illustrates the recruitment process for Phase 3. A total of 56 patients were recruited to the study including 31 community-based ARAS patients and 25 outpatients from PR classes. Ten patients did not respond to follow-up; an 82% follow-up rate. 29 patients originally consented to psychiatric interview and a total of 22 underwent the interview. Of the seven patients who originally consented but did not undergo psychiatric interview, five withdrew their consent and two patients died.

Of the 505 ARAS patients who were invited to participate, 51 (10.1%) responded. Following contact from the author, a total of 31 patients consented to participate in the study, a final response rate of 6.1%. The response rate for patients invited from PR groups was 59.5%.

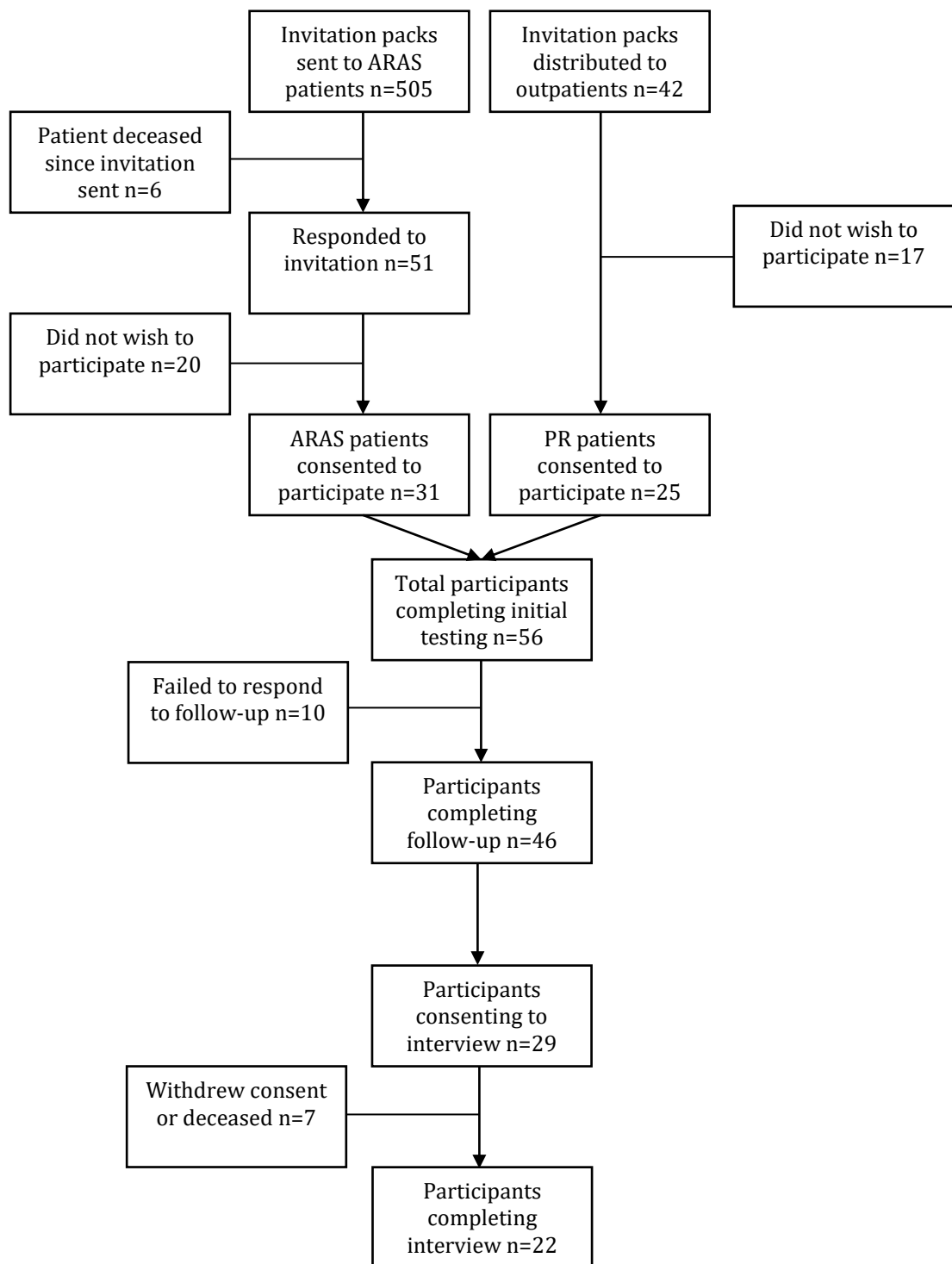


Figure 6.4: Flow chart of Phase 3 recruitment

#### 6.4.4.1 Participant characteristics

Table 6.3 shows the characteristics of the study participants. The majority of participants (96.2%) had moderate-to-very severe COPD according to GOLD (2011) guidelines. Most participants were current or previous smokers with only 6.7% having never smoked. Those participants who currently or previously smoked had a mean smoking history of 42 pack years.

Table 6.3: Phase 3 sample characteristics

	N	
<b>Age (years)</b>	56	69.96 ( $\pm 8.07$ )
<b>Sex (% male)</b>	56	48.2
<b>Recruitment site n (%)</b>	56	
PR		25.0 (44.6)
Community		31.0 (53.4)
<b>Height (cm)</b>	56	163.09 ( $\pm 11.61$ )
<b>Lung function</b>	52	
FEV <sub>1</sub> (L) median (IQR)		0.87 (0.43)
FVC (L) median (IQR)		1.68 (0.73)
FEV <sub>1</sub> /FVC		53.06 ( $\pm 11.66$ )
FEV <sub>1</sub> % predicted median (IQR)		43.50 (23.67)
<b>COPD severity <sup>a</sup> (%)</b>	52	
Mild		3.8
Moderate		25.0
Severe		42.3
Very severe		28.8
<b>Smoking status (%)</b>	45	
Current smoker		26.7
Previous smoker		66.7
Never smoked		6.7
<b>Pack years <sup>b</sup></b>	39	42.49 ( $\pm 21.91$ )

Mean values and SDs are shown unless otherwise noted.

<sup>a</sup> based on GOLD (2011) criteria, <sup>b</sup> one pack year = 20 cigarettes/day for 1 year

PR, pulmonary rehabilitation; FEV<sub>1</sub>, forced expiratory volume in 1 second; IQR, interquartile range; FVC, forced vital capacity

According to the PHQ anxiety screener, 15 patients screened positive for an anxiety disorder (Table 6.4). All 15 of these patients screened positive for PD, with six also screening positive for other anxiety disorders. HADS-A scores indicated that 29 patients had mild-to-severe anxiety and 24 patients had mild-to-moderate depression according to the HADS-D.

Table 6.4: Anxiety disorders and likely cases of anxiety among total Phase 3 sample

	n (%)
<b>PHQ anxiety screener</b>	
<b>Any anxiety disorder</b>	
Case	15 (26.8)
Non-case	41 (73.2)
<b>Panic disorder</b>	
Case	15 (26.8)
Non-case	41 (73.2)
<b>Other anxiety disorder</b>	
Case	6 (10.7)
Non-case	50 (89.3)
<b>HADS cut-off scores <sup>a</sup></b>	
<b>HADS-Anxiety</b>	
Non case ( $\leq 7$ )	27 (48.2)
Mild case (8-10)	13 (23.2)
Moderate case (11-15)	15 (26.8)
Severe case ( $\geq 16$ )	1 (1.8)
<b>HADS-Depression</b>	
Non case ( $\leq 7$ )	32 (57.1)
Mild case (8-10)	14 (25.0)
Moderate case (11-15)	10 (17.9)
Severe case ( $\geq 16$ )	0 (0)

PHQ, Patient Health Questionnaire; HADS, Hospital Anxiety and Depression Scale

<sup>a</sup> Values from Snaith and Zigmond (1994)

The mean (SD) follow-up gap was  $14.7 \pm 5.1$  (range = 9-34) days. Of the 46 participants who completed follow-up, 41 indicated that there had been no major change in their health status, such as an AECOPD. Table 6.5 shows the scores on self-report scales for participants on the first completion and also for those participants who completed the follow-up and had no change in their health status.

Table 6.5: Summary of self-report scale scores for a) participants' first completion (n=56), and b) participants who followed-up and had no major change in their health status (n=41)

<b>a)</b>				
<b>Scale</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean (SD)</b>	<b>Median (IQR)</b>
<b>AIR</b>	0	23	-	7.5 (11.5)
<b>CAT</b>	5	38	24.6 ( $\pm 8.1$ )	-
<b>HADS</b>				
Anxiety	0	16	7.8 ( $\pm 4.5$ )	-
Depression	1	15	7.1 ( $\pm 3.4$ )	-
Total	2	29	14.9 ( $\pm 7.3$ )	-
<b>MRADL</b>	0	21	-	13.0(12.0)
<b>b)</b>				
<b>Scale</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean (SD)</b>	<b>Median (IQR)</b>
<b>AIR</b>	0	30	-	6.0 (11.0)
<b>CAT</b>	0	44	23.4 ( $\pm 10.1$ )	-
<b>HADS</b>				
Anxiety	0	16	-	7.0 (8.5)
Depression	1	15	6.3 ( $\pm 3.6$ )	-
Total	2	29	13.1 ( $\pm 7.5$ )	-
<b>MRADL</b>	0	21	-	12.0(14.0)

SD, standard deviation; IQR, interquartile range; AIR, Anxiety Inventory for Respiratory Disease; CAT, COPD Assessment Test; HADS, Hospital Anxiety and Depression Scale; MRADL, Manchester Respiratory Activities of Daily Living

Table 6.6 compares the characteristics of those who completed follow-up and those who did not. There were no significant differences in age ( $t = 0.85$ ,  $p=0.40$ ), sex ( $\chi^2 = 0.68$ ,  $p=0.50$ ), FEV1 % predicted ( $U = 193$ ,  $p=0.99$ ), pack year smoking history ( $t = 0.08$ ,  $p=0.94$ ), and CAT score ( $U = 229$ ,  $p=0.97$ ) between those participants who completed follow-up and those who did not. However, those who did not complete follow-up had higher anxiety scores on the AIR ( $U = 137.50$ ,  $p = 0.047$ ) and HADS-A ( $t = -2.16$ ,  $p = 0.04$ ), higher total scores on the HADS-T ( $t = -2.17$ ,  $p = 0.03$ ) and lower scores on the MRADL ( $U = 131$ ,  $p=0.03$ ).

Table 6.6: Comparison of sample characteristics between follow up and non-follow up patients

	Completed follow up (n=46)	Did not follow up (n=10)	p value
<b>Age (yrs.)</b>	70.4 (±8.0)	68.0 (±8.6)	0.43 <sup>c</sup>
<b>Sex (male)</b>	21 (46)	6 (60)	0.50 <sup>b</sup>
<b>FEV<sub>1</sub> % predicted</b>	43.6 (24.9)	39.9 (21.7)	0.99 <sup>a</sup>
<b>Gold (2011) classification</b>			0.42 <sup>b</sup>
Mild	1 (2)	1 (11)	
Moderate	12 (28)	1 (11)	
Severe	17 (40)	5 (56)	
Very severe	13 (30)	2 (22)	
<b>Smoking status</b>			0.27 <sup>b</sup>
Current	9 (24)	3 (43)	
Ceased	27 (71)	3 (43)	
Never	2 (5)	1 (14)	
<b>Pack years</b>	42.6 (± 22.6)	41.8 (±19.2)	0.94 <sup>c</sup>
<b>AIR score</b>	7.0 (10.3)	14.5 (13.3)	0.047 <sup>a*</sup>
<b>CAT score</b>	24.2 (±8.1)	23.6 (±11.0)	0.83 <sup>c</sup>
<b>HADS-A score</b>	7.2 (±4.6)	10.5 (±3.2)	0.04 <sup>c*</sup>
<b>HADS-D score</b>	6.7 (±3.4)	8.8 (±3.0)	0.08 <sup>c</sup>
<b>HADS-T score</b>	13.9 (±7.4)	19.3 (±5.6)	0.03 <sup>c*</sup>
<b>MRADL score</b>	14.5 (11.5)	9.5 (5.8)	0.03 <sup>a*</sup>
<b>PHQ anxiety disorder</b>			0.07 <sup>b</sup>
Case	10 (22)	5 (50)	
Non-case	36 (78)	5 (50)	

FEV<sub>1</sub>, forced expiratory volume in 1 second; AIR, Anxiety Inventory for Respiratory disease; CAT, COPD Assessment Test; HADS, Hospital Anxiety and Depression Scale; MRADL, Manchester Respiratory Activities of Daily Living questionnaire; PHQ, Patient Health Questionnaire.

<sup>a</sup> Data reported as median (IQR) with Mann-Whitney U test, <sup>b</sup> Data reported as n (%) with Chi-Squared test, <sup>c</sup> Data reported as mean (SD) with t-test

\*p<0.05

22 patients underwent psychiatric interview at a later date (approximately 3 months after their original participation). The characteristics of this sub-sample are shown in Table 6.7.

Table 6.7: Phase 3 sub-sample (psychiatric interview) characteristics  
(n=22)

<b>Age (years)</b>	71.12 ( $\pm 5.47$ )
<b>Sex (% male)</b>	27.3
<b>FEV<sub>1</sub> % predicted</b>	44.85 (18.31)
<b>COPD severity <sup>a</sup> (%)</b>	
Mild	9.1
Moderate	31.8
Severe	36.4
Very severe	22.7
<b>Smoking status (%)</b>	
Current smoker	27.3
Previous smoker	59.1
Never smoked	9.1
Missing data	4.5
<b>Pack years <sup>b</sup></b>	37.63 ( $\pm 20.55$ )

Mean values and SDs are shown unless otherwise noted.

<sup>a</sup> based on GOLD (2011) criteria, <sup>b</sup> one pack year = 20 cigarettes/day for 1 year

FEV<sub>1</sub>, forced expiratory volume in 1 second

Table 6.8 illustrates the psychiatric disorders that were diagnosed in this sub-sample. Ten patients (45%) had an anxiety disorder. The most common anxiety disorder was PD with or without agoraphobia, whilst the most common mood disorder was current MDD. Nine patients (41%) had more than one psychiatric disorder and seven (32%) patients had both a clinical anxiety disorder and a mood disorder.



Table 6.8: Psychiatric disorders diagnosed from MINI interview

	n (%)
<b>Anxiety disorders</b>	
<b>Any anxiety disorder</b>	10 (45)
GAD	5 (23)
PD with or without agoraphobia	8 (36)
Agoraphobia without history of PD	2 (9)
Social phobia	1 (5)
<b>Mood disorders</b>	
<b>Any mood disorder</b>	9 (41)
Current MDD	7 (32)
Past MDD	1 (5)
Recurrent MDD	1 (5)
<b>Both anxiety and mood disorder</b>	7 (32)

GAD, generalised anxiety disorder; PD, panic disorder; MDD, major depressive disorder

#### 6.4.4.2 Score distribution and group differences

Scores for the AIR ranged from 0-23 (mean (SD) = 9.8 ( $\pm$ 6.7); median = 7.5 (IQR 11.5) and were positively skewed (Shapiro-Wilk Test  $p=0.003$ ) (see Figure 6.5).

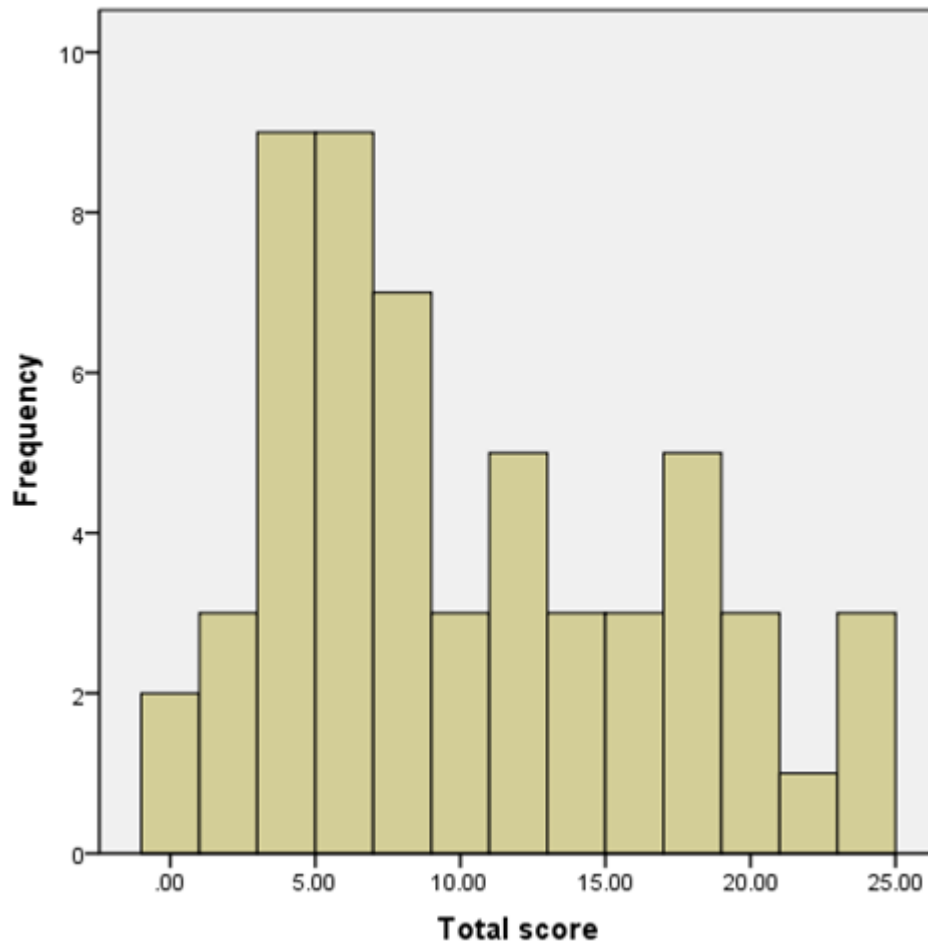


Figure 6.5: Frequency of responses for AIR score (first completion n=56)

There was no difference in total AIR scores between males and females ( $U = 376$ ,  $p=0.80$ ), according to GOLD classification ( $H=2.85$ ,  $p=0.42$ ) and according to smoking status ( $H=3.33$ ,  $p=0.19$ ). There was no statistically significant correlation between AIR score and FEV<sub>1</sub>% predicted ( $r=-0.18$ ,  $p=0.33$ ), age ( $r=-0.24$ ,  $p=0.08$ ) or smoking history in pack years ( $r=0.18$ ,  $p=0.28$ ). Likewise, there was no difference in HADS-A score between sex ( $U=386$ ,  $p=0.93$ ), GOLD classification ( $H=2.41$ ,  $p=0.49$ ), smoking status ( $H=2.06$ ,  $p=0.36$ ), and no correlation with FEV<sub>1</sub> ( $r=-0.03$ ,  $p=0.83$ ), smoking history in pack years ( $r=0.05$ ,  $p=0.78$ ) and age ( $r=-0.26$ ,  $p=0.06$ ).

AIR scores obtained during the psychiatric interviews (n=22) ranged from 0-21 (mean (SD) = 8.8 ( $\pm$ 6.6)) and were normally distributed (Shapiro-Wilk Test  $p=0.153$ ). Figure 6.6 presents the distribution of these scores.

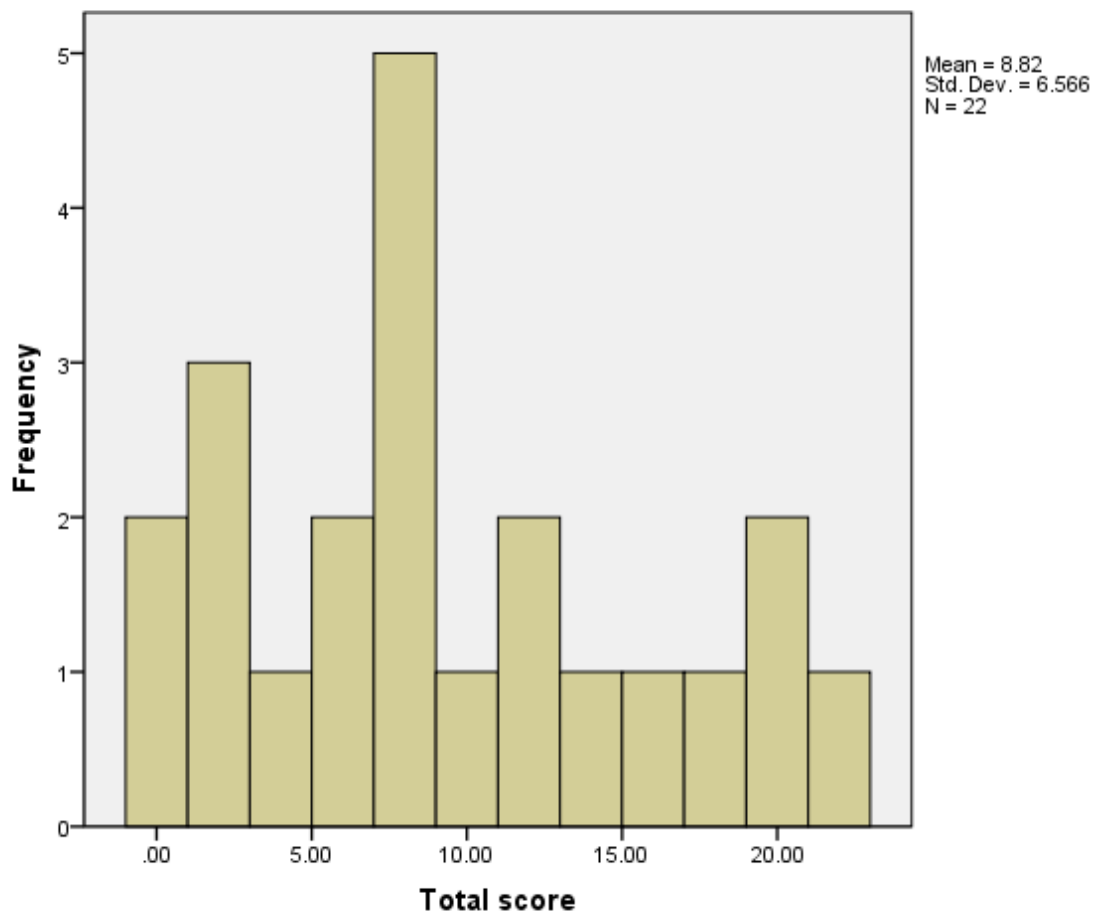


Figure 6.6: Frequency of responses for AIR score (follow-up psychiatric interview sample n=22)

### **6.4.4.3 Reliability**

#### *6.4.4.3.1 Internal reliability*

The Cronbach's  $\alpha$  of the AIR on first completion was 0.92 (95% CI: 0.89-0.95). Cronbach's  $\alpha$  for follow-up data was 0.95 (95% CI: 0.93-0.97). Guttman's split-half coefficient was 0.90 on first completion and 0.93 for follow-up.

#### *6.4.4.3.2 Test-retest reliability*

ICC test-retest reliability was 0.81 (95% CI; 0.67-0.89,  $p < 0.001$ ) for the 41 participants who reported no major change in their health status. ICC test-retest reliability was 0.83 (95% CI; 0.70-0.90,  $p < 0.001$ ) for the HADS-A. Figure 6.7 shows the Bland-Altman plot for the AIR. All but one (97.56%) participant scored within 2 SDs indicating good test-retest reliability. The mean change was 1.76 with a upper limit of agreement of 9.94 and a lower limit of agreement of 6.43.

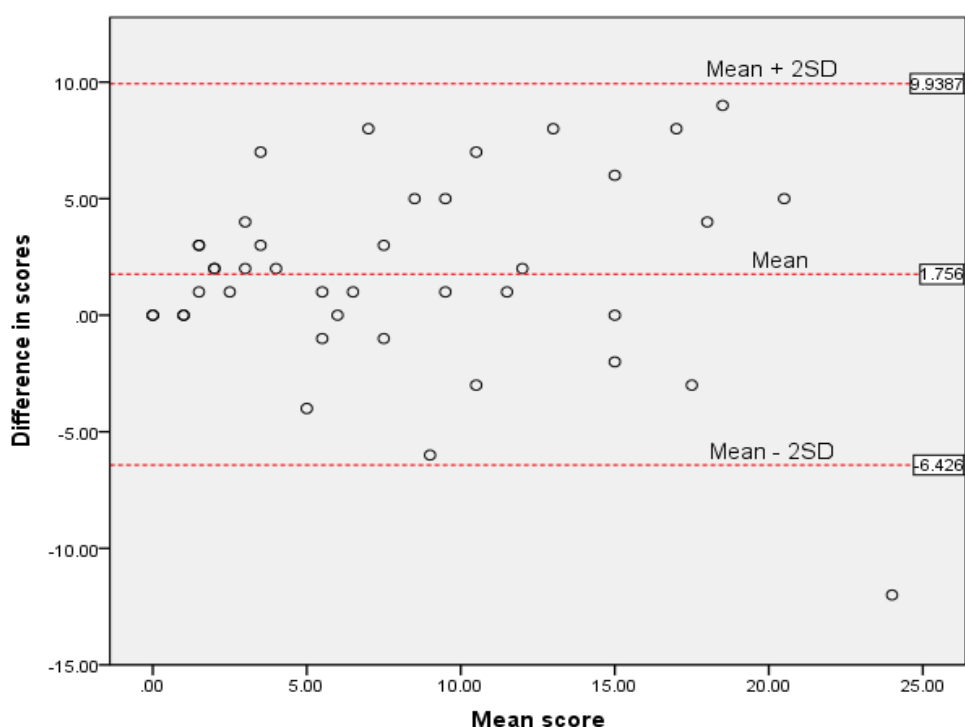


Figure 6.7: Bland Altman plot for AIR

#### 6.4.4.4 Validity

##### 6.4.4.4.1 Known groups validity

Table 6.9 shows the differences in AIR score between anxiety cases and non-cases as diagnosed by the PHQ screener. There was a significant difference in AIR score between these two groups ( $U = 9$ ,  $p < 0.001$ ). A significant difference in AIR score ( $U = 39$ ,  $p < 0.001$ ) was also found between those participants who screened as anxiety cases and non-cases according to the HADS-A (score of  $\geq 11$ ). There was no significant difference in AIR score between the groups in age ( $t = 0.91$ ,  $p = 0.37$ ), sex ( $\chi^2 = 0.20$ ,  $p = 0.89$ ), FEV<sub>1</sub>% predicted ( $U = 253$ ,  $p = 0.99$ ), smoking status ( $\chi^2 = 0.51$ ,  $p = 0.78$ ) and pack year smoking history ( $t = -1.05$ ,  $p = 0.30$ ).

Patients with a PHQ anxiety diagnosis had significantly higher HADS-A scores ( $t = -6.59$ ,  $p < 0.001$ ), HADS-D scores ( $t = -4.37$ ,  $p < 0.001$ ), HADS-T scores ( $t = -6.26$ ,  $p < 0.001$ ), and CAT scores ( $t = -4.10$ ,  $p < 0.001$ ), and significantly lower MRADL scores ( $U = 125.5$ ,  $p = 0.001$ ).

Table 6.9: Comparison of AIR scores between anxiety cases and non-cases based on PHQ screener

	No anxiety diagnosis n=41	Anxiety diagnosis n=15	Statistical difference
<b>AIR score</b>			
Median	6.00	18.00	
IQR	6.00	4.00	
Range	0-16	11-23	U = 9; $p < 0.001$
95% CI lower	5.20	16.83	
95% CI upper	7.77	20.50	
AIR, Anxiety Inventory for Respiratory disease; IQR, interquartile range; CI, confidence interval			

The differences in AIR score between patients with a diagnosed anxiety disorder (diagnoses in psychiatric interview) and those without are shown in Table 6.10. A significant difference in AIR score was found between the groups ( $t = -3.94$ ,  $p = 0.001$ ).

Table 6.10: Comparison of AIR scores between anxiety cases and non-cases according to psychiatric diagnosis

	No anxiety diagnosis n=12	Anxiety diagnosis n=10	Statistical difference
<b>AIR score</b>			
Mean	5.17	13.50	
SD	3.95	5.93	
Range	0-12	5-21	t =-3.94; p=0.001
95% CI lower	2.66	9.26	
95% CI upper	7.68	17.74	
AIR, Anxiety Inventory for Respiratory disease; SD, standard deviation; CI, confidence interval			

#### 6.4.4.4.2 Convergent validity

Table 6.11 shows the correlations between the AIR and the other self-report scales. There were significant correlations between the AIR and HADS-A, HADS-D, HADS-T, CAT and MRADL.

Table 6.11: Spearman's rho correlation of AIR with other self-report scales

	<b>AIR Total</b>
<b>HADS-Anxiety</b>	0.91*
<b>HADS-Depression</b>	0.66*
<b>HADS-Total</b>	0.87*
<b>CAT</b>	0.65*
<b>MRADL</b>	0.52*
AIR, Anxiety Inventory for Respiratory disease; HADS, Hospital Anxiety and Depression Scale; CAT, COPD Assessment Test; MRADL, Manchester Respiratory Activities of Daily Living questionnaire. *<0.001	

According to values proposed by Domholdt (2005), the AIR correlated very highly with the HADS-A (see Figure 6.8), and highly with the HADS-T. There were medium correlations between the AIR and the HADS-D, CAT and MRADL.

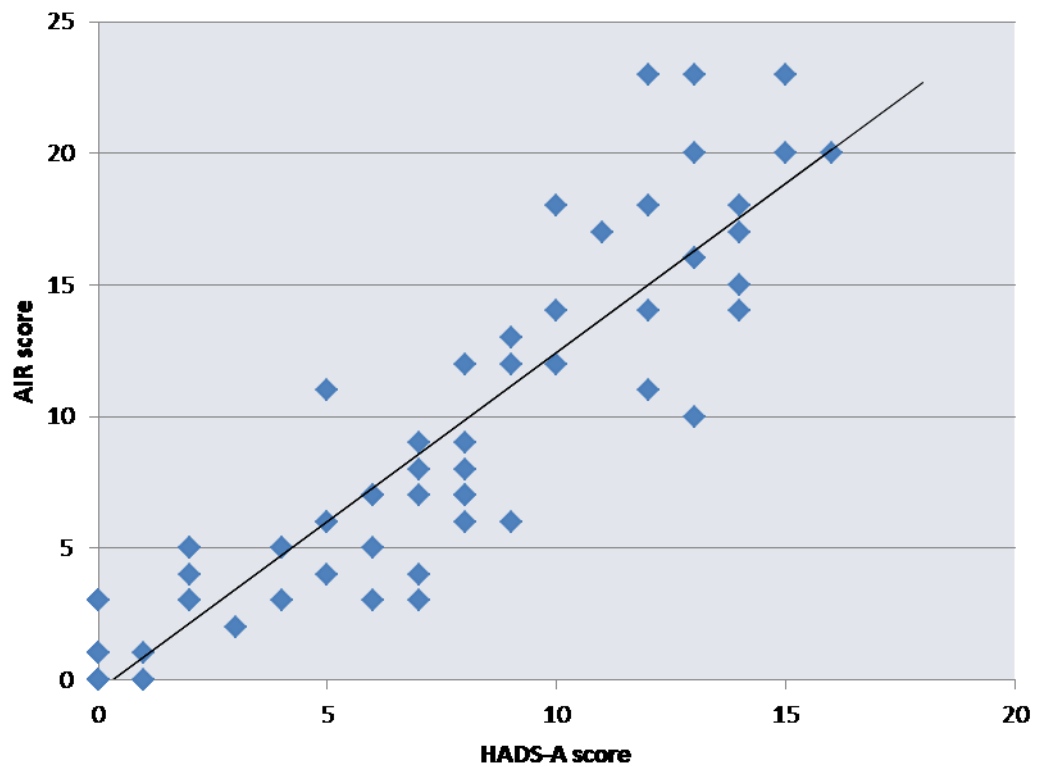


Figure 6.8: Spearman's rho correlation between scores on the AIR and HADS-A

#### 6.4.4.4.3 Construct validity

Table 6.12 shows the model fit indices of all three models that were tested.



Table 6.12: CFA values for single-factor and two-factor models

Model description	df	$\chi^2$	p value	CFI	GFI	NNFI/TLI	RMSEA	SRMSR
<b>Single-factor</b>	35	68.46	0.001	0.90*	0.79	0.88*	0.13	0.05*
<b>Two-factor (a)</b>	34	52.50	0.022	0.95**	0.83	0.93*	0.10*	0.045**
<b>Two-factor (b)</b>	33	39.75	0.20**	0.98**	0.88	0.97**	0.06**	0.04**

df, degrees of freedom;  $\chi^2$ , chi-square; CFI, comparative fit index; GFI, goodness-of-fit index; NNFI, non-normed-fit index; TLI, Tucker-Lewis index; RMSEA, root mean square of error approximation; SRMSR, standardised root mean square residual.

\*acceptable fit, \*\*good fit (based on recommended criteria)

The CFA of the first single-factor model (model 1) tested is shown in Figure 6.9.

Results indicate that the model did not fit the data well.  $\chi^2$  value was significant indicating poor model fit, GFI, RMSEA and TLI were all outside minimum values for acceptable fit, whilst CFI and SRMSR demonstrated acceptable fit. Factor loadings were all positive and significant.

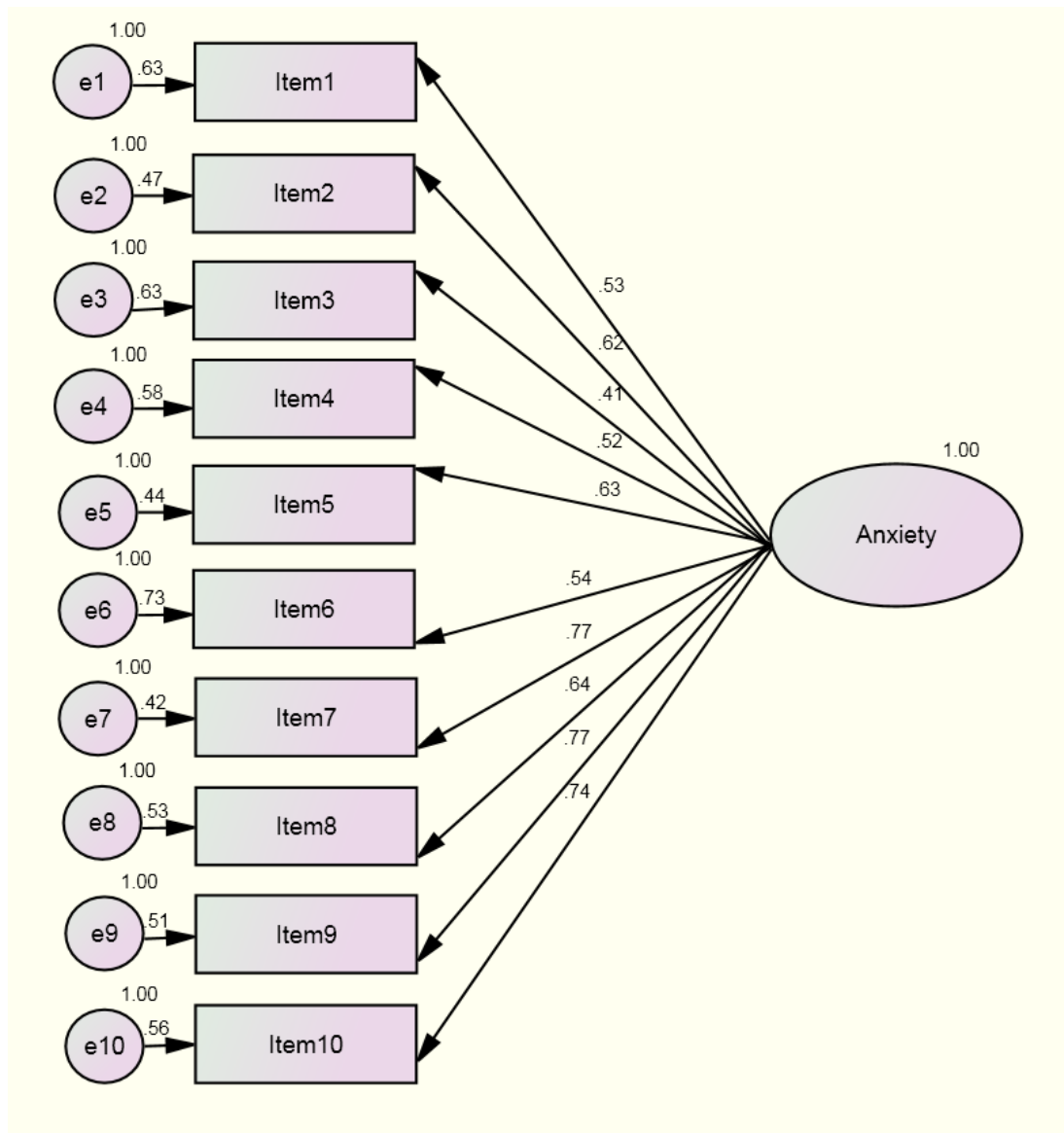


Figure 6.9: CFA for single-factor anxiety model (model 1)

Figure 6.10 shows the CFA for the two-factor model (model 2a). Results show that the model appeared to fit the data better than the single factor model. As before,  $\chi^2$  value was significant ( $p=0.022$ ) and GFI was outside acceptable fit values. However, RMSEA and TLI reached acceptable fit values and values for CFI and SRMSR indicated good fit to the data. Factor loadings for both factors were all positive and significant.

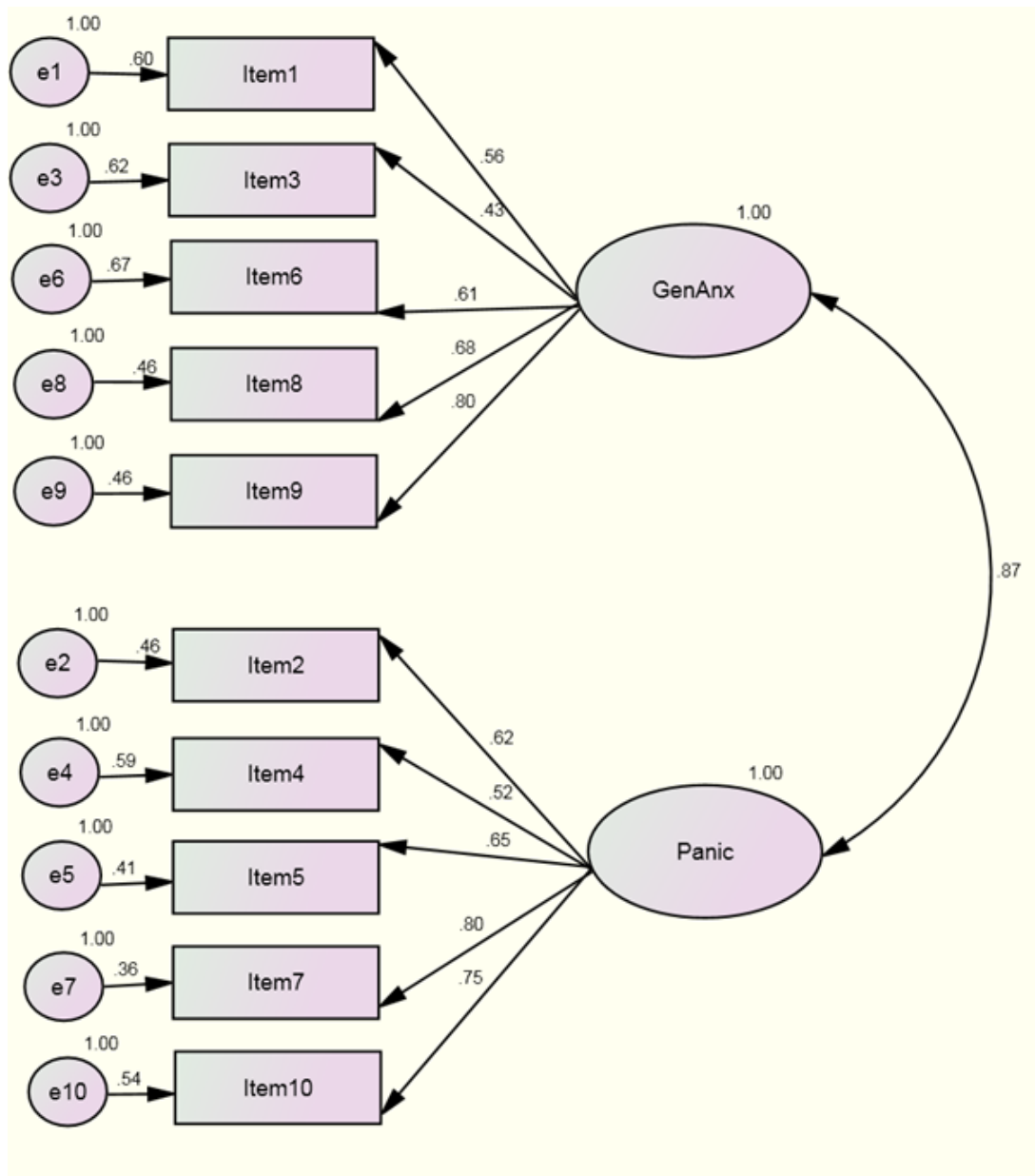


Figure 6.10: CFA for two-factor anxiety model (model 2a)

To determine the areas of misfit in the hypothesised models, modification indices were reviewed. Modification indices suggested a minor adjustment to the two-factor model that resulted in allowing the error terms of item 1 and 3 to covary (Figure 6.11). This fits the conceptualised model as both items reflect a common concept of worry. This minor adjustment to the model had a significant improvement in data fit.  $\chi^2$  reached a non-significant value ( $p=0.20$ ), thus

supporting the model. In addition, GFI (0.88) almost reached an acceptable value. However, values for CFI, TLI, SRMSR and RMSEA all indicated a good model fit. Factor loadings for both factors were all positive and significant.

The two-factor model indicates that there may be two latent variables underlying the AIR that might screen separately for both GAD (general anxiety factor) and PD (panic factor). Therefore, the scores for items 1, 3, 6, 8 and 9 can be totalled to produce a score for general anxiety, and the scores for items 2, 4, 5, 7 and 10 can be totalled to produce a score for panic. Scores for general anxiety range between 0-15 and scores for panic range from 0-15.

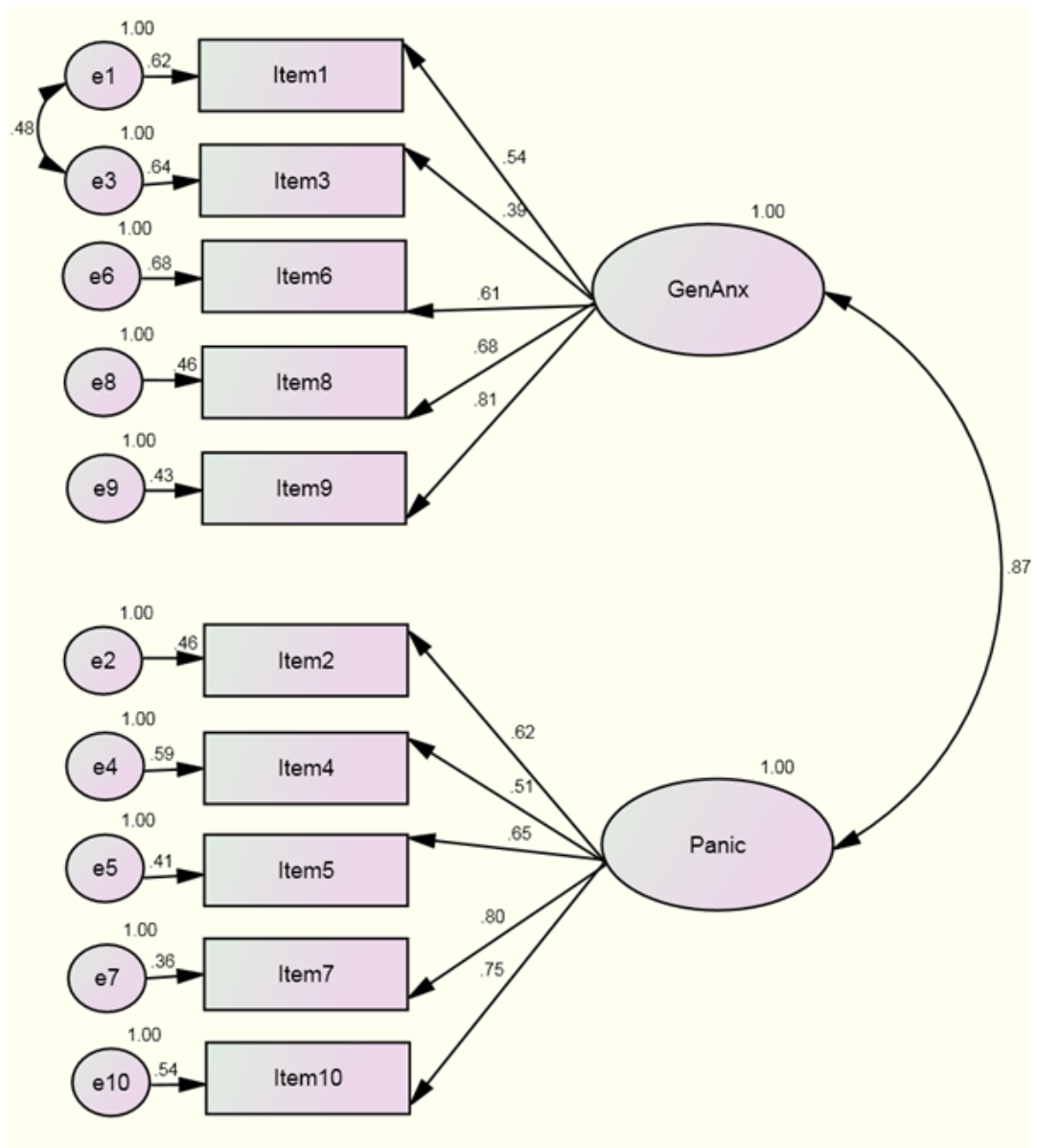


Figure 6.11: CFA for modified two-factor anxiety model (model 2b)

#### 6.4.4.5 Clinical cut-off values

##### 6.4.4.5.1 Total AIR score

ROC analysis was performed on total AIR scores using the PHQ screener as an indication of anxiety case or non-case (see Figure 6.12). AUC for the AIR was 0.96 (95% CI; 0.96-1.00).

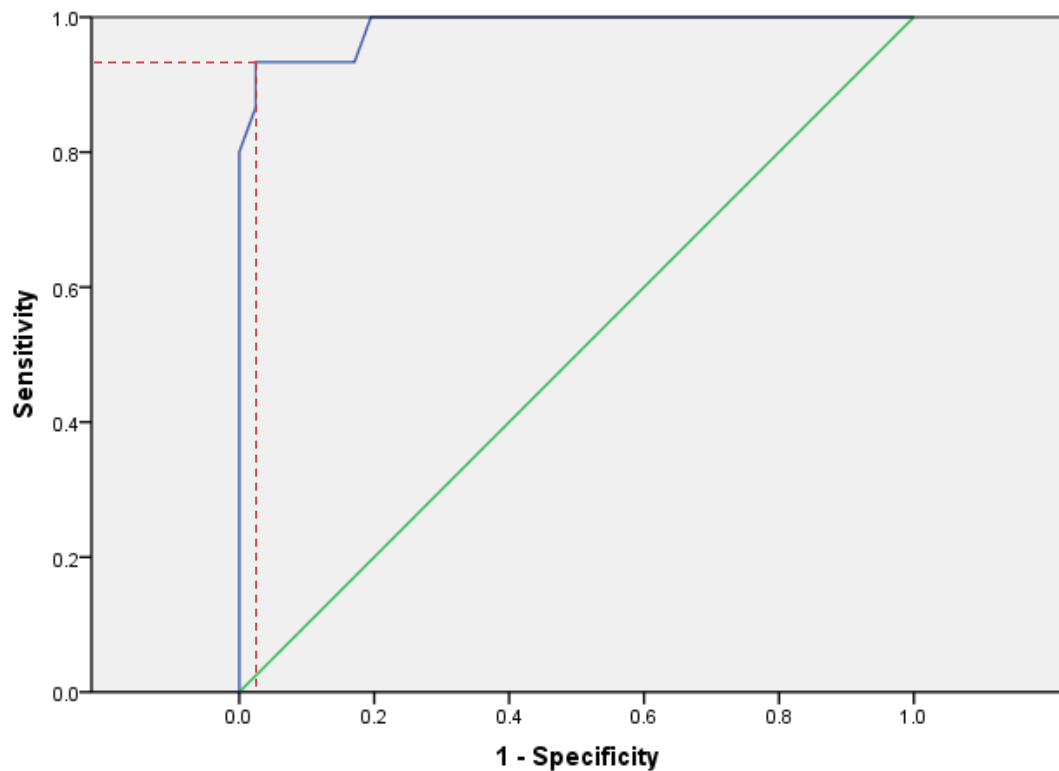


Figure 6.12: ROC curve for AIR (PHQ anxiety screener)

Optimal cut-off value for the AIR (see dashed reference line in Figure 6.12) was 14.5 (a score of 15), which yielded a sensitivity of 0.93, a specificity of 0.98, a PPV of 93% and a NPV of 98% (see Table 6.13). The AUC for PD was 0.96 (95% CI; 0.96-1.00) and for 'other anxiety disorder' was 0.93 (95% CI; 0.86-1.00). The optimal cut-off points for both PD and 'other anxiety disorder' were 14.5. This resulted in a sensitivity of 0.93 and a specificity of 0.98 for the detection of PD and a sensitivity of 1.00 and a specificity of 0.82 for the detection of 'other anxiety disorder.'

Table 6.13: Cut-off scores for AIR (PHQ anxiety screener)

Cut-off score	Sensitivity	Specificity	PPV (%)	NPV (%)
10.5	1.00	0.81	65	100
11.5	0.93	0.83	78	97
12.5	0.93	0.90	78	97
13.5	0.93	0.93	82	97
<b>14.5</b>	<b>0.93</b>	<b>0.98</b>	<b>93</b>	<b>98</b>
15.5	0.87	0.98	93	95
16.5	0.80	1.00	100	93

PPV, positive predictive value; NPV, negative predictive value

A ROC curve was also calculated for the HADS-A (see Figure 6.13). AUC for the HADS-A was 0.93 (95% CI; 0.85-1.00).

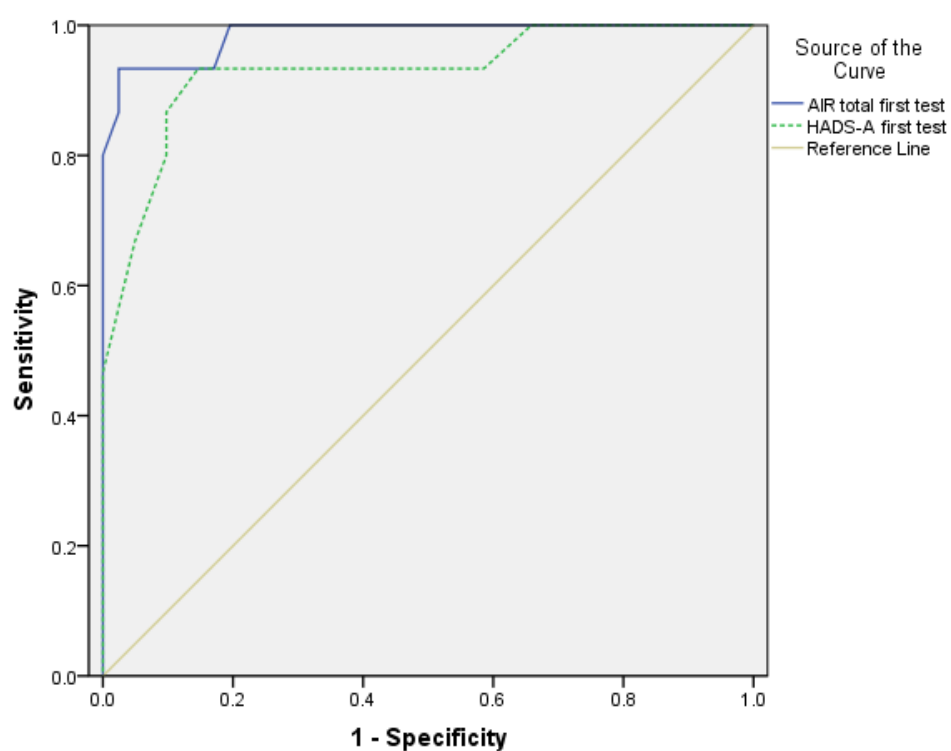


Figure 6.13: ROC curve for HADS-A and AIR (PHQ anxiety screener)

Table 6.14 shows the optimal cut-off value for the HADS-A as an anxiety screener. The optimal cut-off score was 10.5 (a score of 11) which yielded a sensitivity of 0.87, a specificity of 0.92, a PPV of 76% and a NPV of 95%.

Table 6.14: Cut-off scores for HADS-A (PHQ anxiety screener)

Cut-off score	Sensitivity	Specificity	PPV (%)	NPV (%)
4.5	1.00	0.34	36	100
5.5	0.93	0.42	37	94
6.5	0.93	0.51	41	95
7.5	0.93	0.63	48	96
8.5	0.93	0.78	61	97
9.5	0.93	0.85	70	97
<b>10.5</b>	<b>0.87</b>	<b>0.92</b>	<b>76</b>	<b>95</b>
11.5	0.80	0.92	75	93
12.5	0.67	0.95	83	89
13.5	0.47	1.00	100	84

PPV, positive predictive value; NPV, negative predictive value

ROC analyses were also conducted on data collected from psychiatric interviews (n=22). Figure 6.14 shows the ROC curve for clinical anxiety disorders. AUC for the AIR was 0.88 (95% CI; 0.75-1.00).



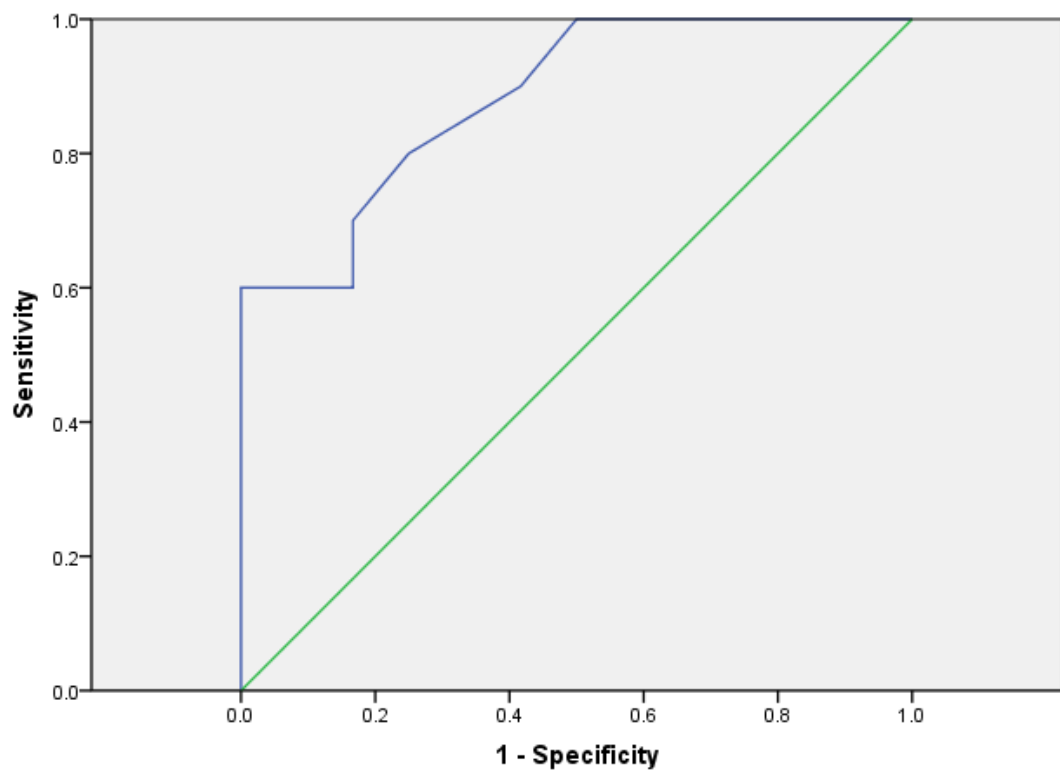


Figure 6.14: ROC curve for AIR (diagnosed anxiety disorder)

A cut-off value of 7.5 (a score of 8) achieved an optimal balance between sensitivity and specificity. This yielded a sensitivity of 0.80, a specificity of 0.75, a PPV of 67% and a NPV of 81% (see Table 6.15). A cut-off value of 8.5 (a score of 9) achieved a higher PPV (78%) with only a slight decrease in NPV (77%).

Table 6.15: Cut-off scores for AIR (diagnosed anxiety disorder)

Cut-off score	Sensitivity	Specificity	PPV (%)	NPV (%)
4.5	1.00	0.50	63	100
5.5	0.90	0.58	64	88
6.5	0.90	0.58	64	88
7.5	0.80	0.75	67	81
8.5	0.70	0.83	78	77
9.5	0.60	0.83	75	71
10.5	0.60	0.83	75	71
11.5	0.60	0.83	75	71
12.5	0.60	1.00	100	75

PPV, positive predictive value; NPV, negative predictive value

#### 6.4.4.5.1 Screening properties of AIR sub-categories

ROC analyses were performed on the two sub-scores of the AIR (panic and general anxiety) using the PHQ anxiety screeners as an indication of anxiety case or non-case. The PD screener of PHQ was used to indicate cases and non-cases of PD and the 'other anxiety disorder' screener of the PHQ was used to screen for cases of other anxiety disorders, primarily GAD. AUC for the AIR-panic score (see Figure 6.15) was 0.95 (95% CI; 0.89-1.00). A cut-off score of 5.5 ( $\geq 6$ ) yielded a sensitivity of 1.00 and a specificity of 0.93 for detecting PD. AUC for the AIR-general anxiety score (See Figure 6.16) was 0.90 (95 % CI; 0.81-0.99). A cut-off score of 8.5 ( $\geq 9$ ) yielded a sensitivity of 1.00 and a specificity of 0.82 for detecting 'other anxiety disorder'.

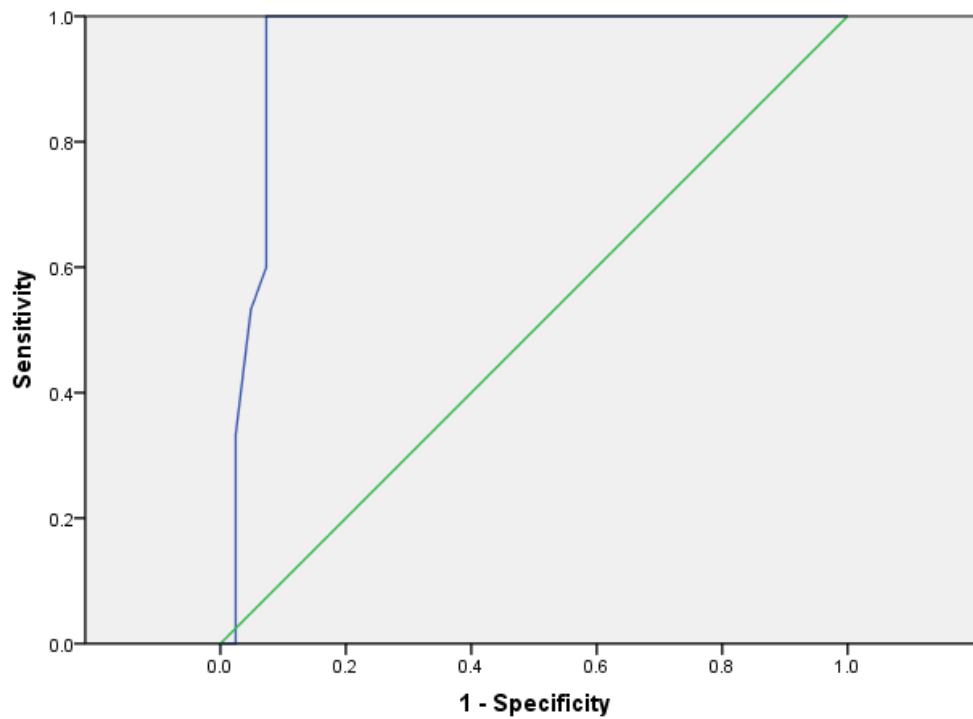


Figure 6.15: ROC curve for AIR-panic (PHQ PD screener)

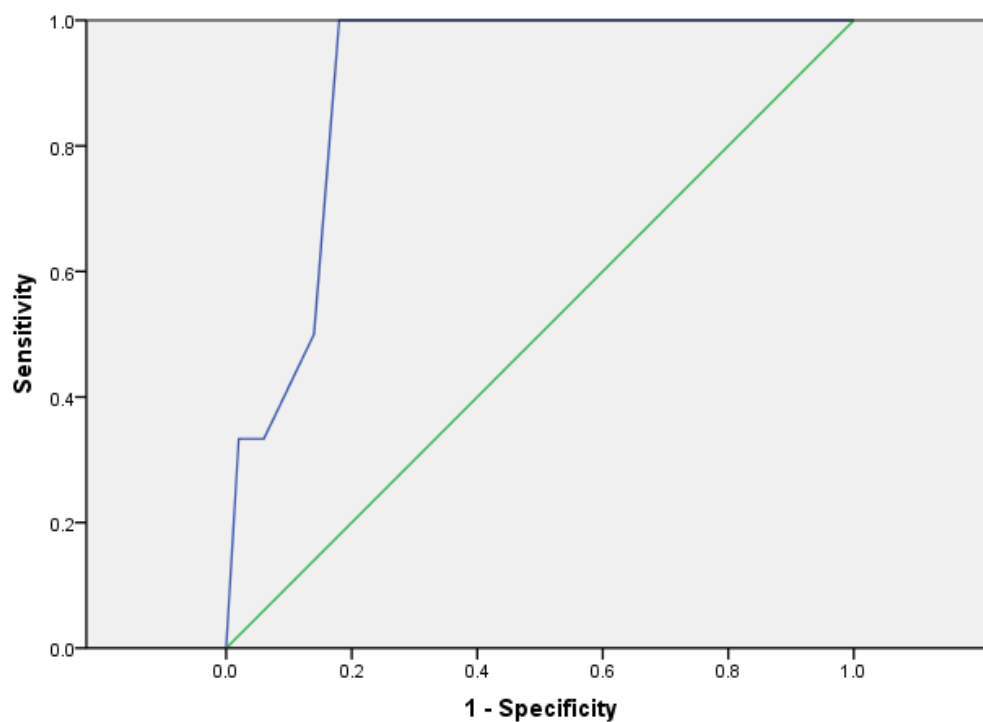


Figure 6.16: ROC curve for AIR-general anxiety (PHQ 'other anxiety disorder' screener)

Due to the small sample in the psychiatric interview follow-up phase, a ROC analysis was unable to be performed for specific anxiety disorders.

#### *6.4.5 KEY FINDINGS OF PHASE 3*

In phase 3, the psychometric properties of the 10-item AIR were established. Reliability was confirmed with data indicating excellent internal consistency and split half reliability. In addition, the scale demonstrated excellent test-retest ICC and Bland-Altman values. Validity was also established in this phase of research. Very high correlations with the HADS-A support the convergent validity of the AIR, whilst significant differences in AIR score between anxiety cases and non-cases confirm discriminant validity. CFA results indicate that the data did not fit the hypothesised single-factor model which was proposed in Phase 2. However, with minor refinements, the data showed a good fit to the two-factor model which contains two sub-scores: panic and general anxiety. Finally, the ROC curve demonstrates that the AIR has excellent clinical utility as a screening tool for clinical anxiety disorders, specifically for PD and GAD based on the two sub-scores.

### **6.5 SUMMARY OF CHAPTER 6**

This chapter outlined Phases 2 and 3 of the research which were concerned with modifying the initial pool of items into an internally consistent scale and subsequent validation of the 10-item scale in a clinical population. Results from

Phase 2 indicate that a 10-item version of the AIR is both internally consistent and factorially valid. Phase 3 results provide further support for the reliability and validity of the scale and suggest that the AIR can be used to screen anxiety disorders accurately, including PD and GAD in patients with COPD. Although CFA in Phase 3 did not support the concept of a single-factor model, a modified two-factor model appears to fit the data well and is consistent with a second hypothesised conceptual model.

In the next chapter, the results from the three phases of research outlined in Chapters 5 and 6 will be discussed in detail and the strengths and limitations of this research will be examined.

## Chapter 7 : DISCUSSION

### 7.1 INTRODUCTION

The results of Phases 1-3 of this research have been presented in Chapters 5 and 6. In the current chapter, these findings will be discussed in relation to the research aim and objectives that were set out at the onset of this thesis (see sections 1.2 and 1.3). The overall aim of this research was to develop a non-somatic anxiety scale that can be used to measure and screen anxiety in patients with COPD. The focus of this discussion, therefore, will be on the psychometric properties and clinical utility of the newly developed AIR. However, the research also explored the experiences of anxiety in patients with COPD and these insights will also be discussed in the current chapter.

In order to address the aim and objectives of this research, the key findings from Phases 1-3 are discussed under the following subheadings:

1. Experiences of anxiety in patients with COPD.
2. Development and refinement of the AIR.
3. Validity, reliability and clinical utility of the AIR

Following the discussion of the research findings, the strengths and limitations of the three phases of research are explored.

### *7.1.1 EXPERIENCES OF ANXIETY IN PATIENTS WITH COPD*

The primary focus of this thesis was to develop a novel anxiety scale that is designed specifically for use in patients with COPD. Phase 1.2 of the research enabled a thorough exploration of the experience of anxiety from the COPD patients' perspective and, in addition to exploring the symptoms of anxiety in patients with COPD, the qualitative interviews permitted an in-depth insight into these first hand experiences of anxiety. The following section discusses some of the key findings from this rich qualitative data.

One important issue arising finding from this qualitative research is that patients with COPD and anxiety report considerable confusion regarding their symptoms. Some participants described how they had lived with the physical symptoms of anxiety for many years without realising that these were due to anxiety. These accounts indicate that many of the physical symptoms of anxiety are readily confused by patients. For example, participants highlighted that it was sometimes difficult to know whether the physical symptoms they experienced were a result of anxiety, their COPD, or the side-effects of COPD-related medications. These findings support Coffman's (2002) assertion that focussing upon somatic symptoms may be misleading during screening. However, this is the first qualitative study (to the author's knowledge) that explores the patients' perspective of this potential confusion. Symptoms such as breathlessness, tachycardia, sweating and trembling were all highlighted as potentially confusing symptoms. These findings therefore provide some additional support for the argument underlying this thesis – that a

measurement/screening tool designed for patients with COPD should focus on the non-somatic symptoms of anxiety whilst omitting potentially confounding somatic symptoms.

Although these qualitative findings support the theoretical model that somatic symptoms may confound the screening of anxiety in patients with COPD, there is some evidence to contradict this stance. A recent study by Fergusson et al. (2006) explored the ability of the somatic items in the BAI to assess anxiety and found that they were valid indicators of anxiety in patients with COPD.

Fergusson and co-worker's (2006) study of the BAI was limited by their failure to include a psychiatric diagnosis in screening their sample for anxiety and by including a predominately male sample. The authors posit that patients with COPD may be more sensitive to their somatic symptoms and may therefore report these more accurately. However, it is evident from the current research that this is not always the case and that patients with COPD readily confuse their somatic symptoms.

Kirmayer and Robbins (1991) argue that the majority of patients who present in primary care with depressive or anxiety disorders present exclusively with somatic symptoms, thus providing additional support for the inclusion of somatic items in screening scales. However, others assert that this is not sufficient reason to ignore the non-somatic symptoms of anxiety. For example, Kroenke (2003) suggests that most patients with an anxiety disorder will admit to psychological symptoms if asked about them, whilst Kunik et al. (2005) affirms that the stigma of mental health causes patients to initially focus on the



somatic symptoms of anxiety, rather than acknowledge their emotional symptoms. Though the participants in the current research gave detailed accounts regarding their somatic symptoms of anxiety, they also readily acknowledged emotional symptoms of anxiety, worry and fear. The elevated risk of false positives when including somatic items (Hill et al., 2008; McDowell, 2006; Steer et al., 1994) and the fact that non-somatic items of anxiety are valid and readily acknowledged by patients supports the non-somatic focus of the current scale.

In addition to supporting the conceptualised non-somatic focus of the new anxiety scale, participants' detailed accounts also provide an insight into the experience, impact and management of anxiety in patients with COPD. Although there are some studies exploring the qualitative accounts of patients with COPD (e.g., Bailey, 2001; 2004; Barnett et al., 2005; Shackell et al., 2007), none have specifically focussed upon experiences of anxiety, particularly in patients with stable COPD. Phase 1.2 explored the detailed experiences of anxiety and builds upon previous research which briefly discuss issues relating to anxiety, predominantly in relation to breathlessness and sleep (Bailey, 2001; 2004; Barnett et al., 2005; Shackell et al., 2007).

Findings from the qualitative phase of this research emphasised the substantial impact that co-morbid anxiety had upon patients' lives. PAs appeared to be particularly disabling with participants describing intense fear, which sometimes cumulated in 'near-death' experiences and resulted in avoidance behaviours. These accounts closely mirror the 'shadow-of-death' stories that

Bailey (2001) reports in her study of patients experiencing AECOPD. However, the current findings indicate that these traumatic 'near-death' experiences can occur outside of AECOPD, often in seemingly 'safe' situations. The distressing nature of these experiences had a lasting legacy and in some cases became pivotal moments that dominated patients' lives. As a result, patients would avoid situations that they felt would cause them to panic, such as situations that resulted in breathlessness, or states in which the patient would feel embarrassed (such as shopping in the supermarket or visiting friends). These experiences indicate that participants in the current study had high levels of anxiety sensitivity, or a fear of anxiety-related sensations (Reiss, 1991). Heightened anxiety sensitivity often arises from beliefs about the harmful consequences of somatic, social or cognitive symptoms of anxiety. Kristensen et al. (2009) assert that people with anxiety disorders exhibit fears about respiratory-related sensations (e.g., dyspnoea) and fears about the occurrence of physical catastrophe (e.g., AECOPD). The fear of anxiety and subsequent avoidance of physical and social situations reported by the participants in this study may help to explain why anxiety has such a deleterious effect upon quality of life and reduced physical capacity among patients with COPD (e.g., Cully et al., 2006; Eisner et al., 2010; Giardino et al., 2010; Kim et al., 2000).

A key finding from this phase of the research was the bidirectional and complex relationship between anxiety and breathlessness. Participants in this study reflected on periods of anxiety through reference to the severity of their breathlessness. Research on the affective dimensions of dyspnoea has found that patients with chronic breathlessness describe their sensations as anxious

thoughts, panic and worry (Carrieri & Janson-Bjerklie, 1986; Coffman, 2002). This might explain the interchangeable nature of terms such as *“breathlessness”*, *“anxious”* and *“panicky”* in these narratives. Recent brain imaging studies have shown that the affective dimension of dyspnoea is processed in areas of the brain that are also activated by the sensations of fear and anxiety, thus supporting the argument that dyspnoea and anxiety might share a common aetiology (Carrieri-Kohlman et al., 2010; LeDoux, 2003; von Leupoldt et al., 2009). The patients in the current research were asked to reflect on their experiences of anxiety and it is possible that some patients, particularly those who had experienced intense dyspnoea reflected upon the affective dimension of their respiratory distress, including dyspnoea-related anxiety.

Some participants in this research used the term ‘vicious cycle’ to describe the complex and escalating relationship between anxiety and breathlessness that they experienced. This cycle of heightening symptoms has been outlined previously and suggest that breathlessness causes a person to become anxious, which in turn leads to further breathlessness, and so on (Bailey, 2004; Coen, 2008; Smoller et al., 1996). One theory that seeks to explain this relationship between anxiety and dyspnoea in patients with COPD has been posited by Bailey (2004), who suggests that anxiety is not a cause of distressing dyspnoea but a sign of longstanding respiratory failure. This relationship, labelled the ‘dyspnoea-anxiety-dyspnoea cycle’, proposes that the presence of anxiety in patients with COPD is a sign that a patient is breathless. The qualitative accounts of the current research provide some support for this theory. Some participants reflected that they became anxious because they were breathless,

particularly if they had been experiencing a period of worsening COPD symptoms e.g., an AECOPD. Breathlessness was also considered to be a trigger for anxiety. Participants described situations where overexertion (e.g., walking up a steep hill) had caused them to become breathless and anxious or “*panicky*”. This often triggered the vicious cycle of escalating anxiety and breathlessness.

According to Bailey’s theory, anxiety is secondary to dyspnoea in patients with COPD, perhaps an affective response to dyspnoea (Carrieri-Kohlman et al., 2010). Bailey et al. (2004) also asserts that anxiety is rarely a cause of dyspnoea in patients with respiratory disease. However, some of the accounts in the present study challenge this assertion. A number of participants reported episodes of acute anxiety and PAs at times when they were not breathless, yet these anxious cognitions often resulted in severe breathlessness and in some extreme cases, led to hospitalisations. In these situations, anxiety might be considered to be a direct cause of dyspnoea rather than a simply a sign of it.

An amended theoretical model is therefore proposed in which anxiety and breathlessness are both considered to be triggers of the ‘vicious cycle’ of anxiety-breathlessness in patients with COPD. This model (see Figure 7.1) posits that anxiety may also be a cause of breathlessness in these patients, rather than merely a sign as Bailey (2004) hypothesises. This was particularly evident among those patients who experienced anxiety which was idiopathic, was caused by external influences (e.g., social discomfort, misplacing medication) and among those who worried about worrying (meta-worry) or had high anxiety sensitivity. In such cases, anxiety should not be considered

solely as a sign of breathlessness. Rather, breathlessness might be considered to be a sign of anxiety.

Contrary to Bailey's (2004) assertions, the findings from the current research indicate that two distinct types of anxiety relationship may exist in patients with COPD: one group who experience anxiety that is a direct result of dyspnoea and the associated affective sensations (Carrieri-Kohlman et al., 2010; von Leupoldt et al., 2009) and another group who become breathless because of anxious thoughts. The levels of breathlessness were not measured in the current research, but it is postulated that those patients experiencing more severe breathlessness or catastrophic misinterpretations of their symptoms (Clark, 1986) are more likely to experience dyspnoea-related anxiety and respiratory-dominated panic (Kircanski et al., 2009). In contrast, patients who experience milder breathlessness are more likely to be affected by anxiety that precedes the breathlessness response and panic which is dominated by cognitive symptoms (Kircanski et al., 2009).

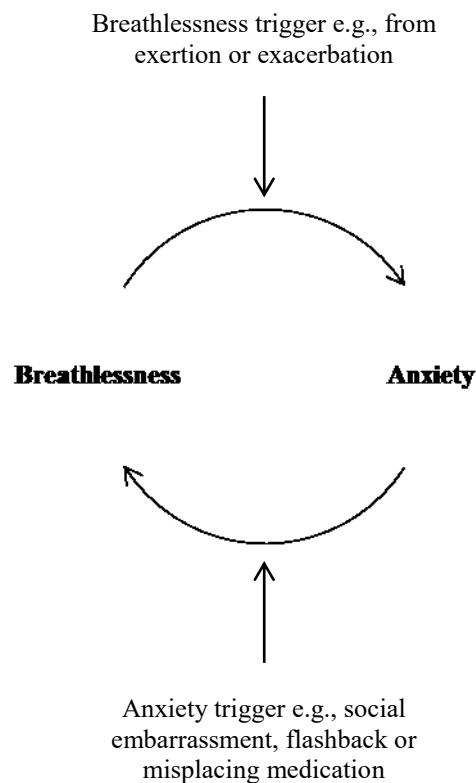


Figure 7.1: Cyclical breathless-anxiety model

The current research also provides a novel qualitative insight into the anxiety management strategies utilised by patients with COPD. Whilst it is unclear if participants had a clinical anxiety diagnosis, or what specific management interventions (if any) they had received, it appears that simple strategies such as self-talk and breathing control were effective management approaches. For example, some participants explained how they would talk themselves through episodes of panic: *"I have just got to sit down and say to myself 'stop it.'" or "I was telling myself to calm down."* This verbal self-regulation approach is representative of skills based CBT (Brewin, 1996). It is not clear whether these self-talk strategies were taught by clinicians, or whether, as Carrieri and Janson-Bjerklie (1986) assert that they were self-developed through living with a

chronic illness. Nevertheless, the accounts from the present study support previous findings advocating the role that self-talk coping strategies and CBT can have in patients with anxiety (Barankiak & Sheffield, 2011; Hynninen et al., 2010; Kemppainen et al., 2003).

### *7.1.2 DEVELOPMENT AND REFINEMENT OF THE AIR*

The AIR covers a range of anxiety symptoms using items which were developed using both emic and etic perspectives. The original 16 items were written specifically to reflect both the anxiety symptoms reported by patients with COPD and the markers of anxiety in existing anxiety scales. This approach allowed a pool of items to be developed which represented the full coverage of non-somatic anxiety symptoms and to identify whether any symptoms were not included in extant scales (Rowan & Wulff, 2007). This mixed-methods design enhanced scale fidelity by allowing the words of patients to guide the writing of new scale items (Collins et al., 2006; Yorke et al., 2010). The involvement of an ERG throughout the scale development process is consistent with guidelines on scale development (FDA, 2009) and allowed content validity, face validity and usability to be maximised.

Although there was a high level of convergence between patient-reported symptoms and those contained within extant scales, mapping of symptoms demonstrated that two pertinent themes highlighted in the qualitative interviews were not sufficiently covered in existing anxiety self-report scales: anticipatory worry and anticipatory panic. Anticipatory worry about daily

activities was frequently cited by participants and was often due to catastrophic predictions about future events i.e., a fear of becoming breathless or embarrassed. It is not clear whether any of the participants who were interviewed in the current study had a clinical anxiety disorder, but symptoms of anticipatory worry are commonly found in a number of anxiety disorders including GAD and phobias (APA, 2000). Anticipatory panic on the other hand, is a common symptom of PD and often occurs when patients experience significant anxiety over the prospect of experiencing a future PA (APA, 2000). Anticipatory panic may be particularly relevant to patients with COPD because their repetitive exposure to breathlessness can lead to a higher sensitivity to PAs and thus a higher frequency of distressing panic events (Harvey et al., 2008).

It is generally accepted that PD, PAs and subclinical panic are common in patients with COPD. Alongside the expected somatic symptoms, the qualitative accounts in the current research contained frequent references to cognitive symptoms of panic including intense fear and sudden panic episodes. Yet, the majority of extant scales identified in this study have only limited reference to non-somatic symptoms of panic. This may be because the diagnosis of PA and PD is dominated by somatic symptoms (APA, 2000) which is reflected in the content of extant scales. The conceptual model of the AIR supported the need for panic symptoms to be included within the item pool but also required somatic items to be omitted. Therefore, several non-somatic items specific to PD were developed including symptoms relating to PAs (e.g., frightened, panicky, losing control) and anticipatory panic (e.g., thoughts of something bad



happening, worry about panic). At a conceptual level, the AIR is therefore able to assess symptoms of panic without the inclusion of potentially confounding somatic items.

Although the original 16 items developed in Phase 1 covered the key symptoms of non-somatic anxiety highlighted through both emic and etic perspectives, the goal was to develop a shorter scale with a high internal consistency. In Phase 2 of the current research, the 16 items developed in Phase 1 were subjected to item and factor analysis. The criteria used for item retention in the current research were comparable to those used by other scale developers (e.g., Al-Shair et al., 2009; Delamere et al., 2001), but they were also more robust, thus ensuring that only the best performing items were retained. For example, Delamere et al. (2001) advocates retaining items with item-total correlation of  $>0.3$  whereas the current research employed a more robust cut-off of 0.55. Such robust statistical procedures support the claim that the AIR contains a group of highly intercorrelated items.

The pool of items developed in Phase 1 deliberately included a single positively worded item to identify if response bias was present. Subsequent statistical analysis revealed that this item was not a reliable item (having particularly low item-total correlation and communality values). This finding indicates that a response bias, or 'careless responding' (Magazine et al., 1996) may have indeed been present amongst this sample. The single positively worded item appeared at the end of the scale so it is possible that respondents did not read each question clearly and instead responded to the item in a similar fashion to the

previous 15 items. Alternatively, the poor performance of this item during item analysis and EFA may instead reflect the fact that positively and negatively worded items measure different underlying variables (Weems et al., 2003). For example, research exploring the factor structure of the STAI indicates that distinct negative-worded and positive-worded factors can exist in anxiety scales (Mook et al., 1991). Although some scale developers recommend that a mix of positively and negatively worded items are included in a scale (e.g., Nardi, 2003), there is growing acceptance that this practice is often flawed (Weems et al., 2003). There is evidence to suggest that respondents may process negatively and positively worded items differently or that they may not always identify changes in positive/negative wording (Weems et al., 2003). This supports the decision to use negatively worded items in the final version of the AIR.

Some scale developers choose to retain items that do not fit the pre-determined statistical criteria. This is usually done when it is felt that an item taps into a particularly important aspect of the construct that is not covered by other items (DeVellis, 2003). The strategy used in the current research was characterised by a 'maximisation of internal consistency' approach, which produced a scale with diverse symptom coverage and a high level of internal consistency. Some items that were developed in Phase 1 were removed during Phase 2 because their performance in a larger sample of COPD patients demonstrated that they were not statistically robust for inclusion in the final scale. The final 10-item AIR achieved an excellent internal consistency (Cronbach's  $\alpha = 0.95$ ) and analysis indicated that the removal of further items would both lower consistency and reduce symptom coverage. Therefore, the 10-item AIR produced the optimal

balance of reliability and item coverage. Although a shorter version of the scale may have reduced item redundancy, it would have also reduced symptom coverage. A shorter version may have also reduced respondent burden, but ERG feedback supported the AIR's face validity and indicated that the scale was quick and easy to complete. Respondents in the pilot study took an average of 95 seconds to complete the AIR, which is quicker than other extant scales used to assess markers of anxiety patients with COPD. For example, the HADS takes between 2 and 5 minutes to complete, whilst the BAI takes approximately 5 minutes (McDowell, 2006).

Score variability of the AIR was inconsistent across Phases 2 and 3. For example, Phase 2 and initial Phase 3 data demonstrated that scores on the AIR were positively skewed. In contrast, data from the Phase 3 psychiatric follow-up sample showed normal distribution of scores. It is not clear whether this variability was due to the design of the AIR (e.g., an inadequate response set) or whether this was due to sampling deficiencies. The use of the HADS-A in Phase 3 test-retest data (which was also positive skewed) demonstrate that this follow-up sample did not have good variability in anxiety symptoms, particularly towards the severe end of the anxiety spectrum. Other researchers suggest that positive skew on anxiety scales is not uncommon and may simply be because extreme levels of anxiety are rare (Bruzzese et al., 2011). This is certainly a possibility in such small samples and is supported to some extent by the fact that maximum recorded HADS-A score was 16 out of a possible 21.

Although further confirmation of score variability is needed in considerably larger clinical samples, these initial findings indicate that the response set for the AIR may need to be reconsidered in future studies. It appears that the response options representing the milder symptoms of anxiety (i.e., '*Not at all*' and '*Occasionally*') may need to be re-worded, or extended. For example, a fifth response option such as '*Very rarely*' may be added between these two options. Alternatively, '*Almost all of the time may*' be too extreme a response, which is unlikely to be endorsed by respondents. Although ERG input during scale development did not highlight any problems with the response set, only four patients were involved. Participants were also restricted in their feedback to issues relating to user-friendliness of the scale and not specifically to suitability of response sets. A cognitive debriefing approach, such as that described by Ploughman et al. (2010) may have been a more appropriate strategy for exploring the suitability of the response set. Cognitive debriefing is a qualitative method which assesses respondents interpretation of a scale in terms of comprehension, retrieval, judgement, response set and respondent burden (Ploughman et al., 2010).

Initial EFA in Phase 2 revealed a strong single-factor solution, suggesting that there is a clear latent variable ('*anxiety*') underlying the AIR. The items contained within the AIR are to some extent specific to both GAD and PD (see Table 5.8 in section 5.5.1), so it was anticipated that the scale might contain two intercorrelated factors that represent each of these disorders. The single-factor solution found in Phase 2 suggested that the AIR measured a global construct of anxiety, as opposed to differentiating between panic and general anxiety. The

high communalities and factor loadings found in Phase 2 indicate that EFA was likely to be reliable even on a relatively small sample (Fabrigar et al., 1999; MacCallum et al., 1999).

Boyle (1985) asserts that clinicians generally require outcome measures that measure the severity of a disorder, rather than a specific element of that condition. An important strength of the AIR is that it demonstrates broad symptom coverage and includes items from three of the four symptom themes identified in Phase 1. Although the item related to behavioural anxiety was removed during the item analysis stage (as it was not endorsed by the respondents), the scale covers a comprehensive range of anxiety symptoms that include psychic tension, apprehension and panic and, therefore, provides a measure of the general severity of anxiety as Boyle recommends. The broad symptom coverage should also enhance the AIR's clinical utility as a screening tool by heightening sensitivity, which, according to Jain and Lolak (2009) is the most important feature of an anxiety screening tool. McDowell (2006) asserts that other self-report scales which measure both anxiety and depression (e.g., DASS and HADS) may sacrifice sensitivity at the price of specificity by focussing on symptoms that discriminate between the two disorders rather than measuring the whole construct.

### *7.1.3 VALIDITY, RELIABILITY AND CLINICAL UTILITY OF THE AIR*

In Phase 3, the psychometric properties of the AIR were established in a clinical population of community-dwelling patients with stable COPD. The following

section discusses the validity and reliability of the AIR for assessing the severity of anxiety, and the clinical utility of the AIR to screen for anxiety disorders. Other key findings from Phase 3 of the research are also discussed within this section, namely the prevalence of anxiety disorders among this sample and their corresponding characteristics.

#### **7.1.3.1 Validity**

The validity of the AIR was demonstrated by testing a number of *a priori* hypotheses relating to convergent and construct validity.

The very high correlation between the AIR and the HADS-A demonstrates that the AIR has excellent convergent validity with the most widely utilised marker of anxiety in patients with COPD. This high correlation compares favourably with other studies exploring convergent validity of anxiety markers. For example, studies exploring the convergent validity of the BAI with the STAI have found correlation coefficients of between 0.44 and 0.68 (McDowell, 2006). As hypothesised, the AIR also correlated moderately with the HADS-D. This is consistent with the postulated overlap between anxiety and depression (Clark, 1989; Clark & Watson, 1991; Hirschfeld, 2001). The AIR was designed to assess markers of anxiety, rather than distinguish between anxiety and depression as other scales have been designed to do (e.g., BAI). Therefore, it contains a broad spectrum of symptoms including feeling upset and feelings of anxiety that may relate to both anxiety and depression (APA, 2000). However, the enhanced

correlation of the AIR with the HADS-A compared to the HADS-D supports the construct validity of the AIR as primarily an anxiety outcome measure.

The AIR also demonstrated excellent known groups validity. Significantly different total scores were found between patients with a clinical anxiety disorder and those without based on both PHQ screening and psychiatric interview. This provides further support for the scale's construct validity and demonstrates that scores for the AIR distinguish between anxiety cases and non-cases as hypothesised.

The factorial validity of the AIR was less clear. Although the results from Phase 2 suggested that a single factor underlies the AIR, it was also hypothesised that two factors representing the conceptualised model of intercorrelated general anxiety and panic may provide the best fit. The original design of the items demonstrated that symptoms covering both GAD and PD were present in both the 16-item and 10-item versions of the scale. CFA demonstrated that the single-factor model (a single '*anxiety*' factor) showed poor fit to the data with only the CFI, TLI and SRMSR indicating acceptable fit. In contrast, the modified two-factor model of '*general anxiety*' and '*panic*' demonstrated good fit on five of the six model fit indices and borderline fit on the remaining index (the GFI). The modification to the two-factor model fitted the original conceptual model of the AIR as items 1 and 3 both reflect cognitive worry. The two-factor model produces three scores: a panic score (five items on the AIR-panic factor), a general anxiety score (five items on the AIR-general anxiety factor), and a total score (all 10 items).

Although the CFA demonstrated a good fit to the two-factor model, it is important to consider the impact that sample size may have had on this study. General issues relating to sample size for CFA are discussed in greater detail in the limitations section of this chapter (section 7.3.3). However, sample size may also have had a specific impact upon fit indices. For example, both the GFI and SRMSR are sensitive to sample size with larger samples reporting poorer fit values (Miles & Shevlin, 1998). In contrast, it has been suggested that the CFI demonstrates stable patterns across a range of sample sizes (Tanguma, 2001). This may explain why the GFI values were all below acceptable ranges, whilst the CFI values were acceptable or good for all models. The results of the current CFA show that even in small sample, the modified two-factor model demonstrated good fit to the data.

#### **7.1.3.2 Reliability**

The internal consistency of the AIR in Phase 3 was found to be very high, ranging from an  $\alpha$  value of 0.92 in the initial sample to 0.95 in the 2-week follow-up sample. This is consistent with data exploring the reliability of other anxiety scales. For example, internal consistency of the HADS-A has been reported to range from  $\alpha = 0.76-0.93$  in a range of clinical settings, whilst reported values for the BAI range between  $\alpha = 0.86$  and  $\alpha = 0.94$  (Bjelland et al., 2002; McDowell, 2006). Although high internal consistency ( $>0.90$ ) may indicate item redundancy in some circumstances (Streiner and Norman, 2003), the internal consistency values reported for the AIR achieve the minimum value of 0.90 recommended by Kline (2000) for scales that are designed for clinical



use. Boyle (1985) argues that items in scales with high internal consistency are often just paraphrases of each other, but it is clear from the content of items that each item relates to a unique symptom of the overall anxiety construct and has a specific role in assessing markers of either general anxiety or panic. Boyle (1985) also contends that high internal consistencies are likely to result in narrow syndrome measurement and poor symptom coverage, leading to poor validity in recognising psychiatric diagnosis. However, the results of this study show that despite high internal consistency, the AIR has excellent known groups validity (see section 7.2.4.1) and screening properties (see section 7.2.4.3). The AIR, therefore, achieves good item coverage, whilst maximising internal consistency.

In addition to high internal consistency, the AIR demonstrated excellent temporal stability over a 2-week test-retest period. The ICC of 0.81 found in this study demonstrates that the AIR is relatively stable over this period.

Comparable 1-week test-retest reliabilities have been found in a large study exploring the validity of HADS-A (0.80) and BAI (0.77) in patients with Parkinson's disease (Leentjens et al., 2008). As the AIR is designed to assess markers of state anxiety and uses a 2-week timeframe, the test-retest scores might be expected to be slightly lower than those reported for shorter time-periods. Boyle (1985) asserts that a paradox of high test-retest values is that the scale might actually be insensitive to changes in symptoms. However, the current research also found a similar 2-week ICC test-retest reliability for the validated HADS-A (ICC = 0.83) suggesting that anxiety symptoms remained relatively constant over the time-period. The transient nature of state anxiety

means that although temporal stability for the AIR was good over a 2-week period, it would be expected to decrease as the time gap increases.

An interesting finding in Phase 3 was that patients with higher levels of anxiety (assessed using both the AIR and the HADS-A) and worse functional status (measured on the MRADL) were less likely to complete the follow-up. Although it is not clear why this might be, it is possible that patients who are anxious and/or have impaired function in daily activities are less motivated or less able to participate in research. One possibility is that patients were unable to follow-up if they had experienced an AECOPD or hospitalisation. There is some evidence to suggest that patients with anxiety are at increased risk of exacerbations and hospitalisations (Eisner et al., 2010; Yohannes et al., 2000a) but without detailed follow-up data, this assertion cannot be confirmed.

#### **7.1.3.3 Clinical utility as a screening tool**

Data from Phase 3 demonstrated that the AIR was able to accurately screen for anxiety disorders in patients with COPD. Using the PHQ anxiety screeners as a case-finder for anxiety disorders, the AIR demonstrated an AUC of 0.96. Follow-up diagnostic data found a similarly high AUC of 0.88 in a smaller sample of 22 patients who underwent psychiatric interview. These results suggest that the AIR has excellent clinical utility as a screening tool for detecting patients with clinical anxiety. However, the optimal cut-off score for clinically relevant symptoms differed between the two tests. Initial data in Phase 3 suggested that a cut-off score of  $\geq 15$  provided the optimal balance between sensitivity and

specificity. In comparison, when formal diagnostic interviews were undertaken during follow-up, an optimal cut-off score of  $\geq 8$  was found to provide the best balance between sensitivity and specificity. This variation in cut-off scores may have been due to the small sample size that was included in the second data set. This is reflected in the wider CIs that were found in the second data set compared to the first (0.75-1.00 vs. 0.96-1.00).

Although this research found differences in optimal cut-off score depending on the sample, the ability of the AIR to screen for patients with anxiety disorders remains excellent. When the gold standard psychiatric diagnosis was utilised, the AIR provided improved screening properties in comparison to existing scales. For example, a recent study exploring the clinical utility of the HADS-A and GAI to screen for anxiety in patients with COPD (based on MINI diagnosis) found an AUC of 0.79 and 0.83 respectively (Cheung et al., 2012). A cut-off score of  $\geq 8$  on the AIR (based on psychiatric diagnosis of an anxiety disorder) yielded a sensitivity of 0.80, a specificity of 0.75, a PPV of 67% and a NPV of 81%. In comparison, Cheung and colleagues (2012) report a sensitivity of 0.79, a specificity of 0.71, a PPV of 47.8% and a NPV of 90.6% for the optimal cut-off score on the HADS-A. Sensitivity and specificity of the AIR were similar to that found for the GAI (0.86 and 0.78), and whilst NPV was elevated for the GAI (94%), the PPV of the GAI was considerably lower than that found for the AIR in the current research (57%).

This research also explored the utility of the HADS-A to screen for anxiety disorders in patients with COPD. When the PHQ anxiety screeners were used to

indicate cases or non-cases of clinical anxiety, the AIR performed marginally better than the HADS-A, demonstrating a slightly larger AUC (0.96 vs. 0.93). Although both scales had excellent screening properties, the sensitivity, specificity, PPV and NPV of the HADS-A were all lower when compared to the AIR. The most important screening property for an anxiety scale is sensitivity as it is important to recognise as many patients as possible who may have an anxiety disorder so that further diagnosis can be undertaken (Jain & Lolak, 2009; Vodermaier & Millman, 2011). Findings from the current research indicate that the AIR has a higher sensitivity for screening anxiety disorders than the HADS-A (0.93 vs. 0.87).

The high prevalence of both PD and GAD reported in Phase 3 of the current study support the conceptual framework underpinning the AIR; that the scale should be able to screen for both PD and GAD in patients with COPD. ROC analyses in Phase 3 indicate that the AIR is able to accurately identify patients with both disorders. Data from the 22 patients who underwent psychiatric interview suggest that the AUC for cases and non-cases of PD is 0.85 (95% CI: 0.68-1.00), whilst for GAD it was 0.79 (95% CI: 0.61-0.98). Similarly, ROC analyses of the larger sample (n=56) who completed the PHQ anxiety screeners found excellent AUCs for PD (AUC = 0.96; 95% CI: 0.96-1.00) and 'other anxiety disorders' (AUC = 0.93; 95% CI: 0.86-1.00), which include GAD. The sensitivity of the AIR for the detection of PD and 'other anxiety disorders' was 0.93 and 1.00 respectively. These findings indicate that the AIR is able to identify correctly the majority of patients with PD and GAD, thus supporting its clinical utility as an anxiety screener for patients with COPD.

The CFA undertaken in Phase 3 identified that the AIR measured two sub-factors: panic and general anxiety. Although it was not practical to perform ROC analyses on the subcategories of AIR-panic and AIR-general anxiety based on psychiatric diagnosis (due to the small sample size), analyses were performed using the PHQ screeners for both PD and 'other anxiety disorder'. The performance of the AIR-panic subscale in screening for PD according to PHQ was excellent (AUC = 0.95). A score of  $\geq 6$  (out of 15) yielded a sensitivity of 1.00 and specificity of 0.93 indicating that the AIR-panic is able to maximise true positives and identify almost all true negatives. The performance of AIR-general anxiety in detecting 'other anxiety disorder' was also excellent (AUC = 0.90) with a score of  $\geq 9$  (out of 15) on the AIR-general anxiety yielding a sensitivity of 1.00 and a specificity of 0.82. Although the 'other anxiety disorder' screener in the PHQ screens for both GAD and anxiety not otherwise specified, there is empirical evidence to suggest that it primarily identifies patients with GAD (e.g., Hahn et al, 2004; Spitzer et al., 1999). Though the screening utility of the two sub-scores requires further exploration in larger populations with confirmed psychiatric diagnoses, these initial findings indicate that the AIR might be used to accurately screen for both PD and GAD.

#### **7.1.3.4 Prevalence of anxiety and mood disorders**

A cut-off score of  $\geq 8$  on the HADS-A indicated that over half (51.8%) of the patients in the initial Phase 3 sample had clinically relevant symptoms of anxiety. Using a more rigorous cut-off, a score of  $\geq 11$  identified that 28.6% of

patients had moderate-to-severe anxiety (Snaith and Zigmond, 1994). The PHQ screener identified a similar proportion of patients with a clinical anxiety disorder (26.8%). Recent studies report comparable prevalence of likely anxiety, ranging from 10% to 57% depending upon the type of screening tool used, choice of cut-off score and study population. For example, a large (n=406) multi-centre epidemiological study by Gudmundsson et al. (2005) found that 41% of patients had mild-to-severe symptoms of anxiety based on a cut-off score of  $\geq 8$  on the HADS. Similarly Cleland and co-workers (2007) report a prevalence of likely anxiety (based on HADS-A score  $\geq 11$ ) of 32.7% in a sample of 170 community COPD patients.

The prevalence of clinical anxiety disorders (diagnosed through psychiatric interview) in patients with COPD is reported to be 10-55% (Aghanwa & Erhabor, 2001; Vögele & von Leupoldt, 2008). The findings from the current research suggest that 45% of patients had a clinical anxiety disorder based on psychiatric diagnosis. Whilst the sample in this study is small (n=22) it is comparable in size to two frequently cited studies from Nigeria and Germany who report prevalence based on samples of 20-30 subjects (Aghanwa & Erhabor, 2001; Vögele & von Leupoldt, 2008). The prevalence of anxiety reported in the current study is in line with data from a large Canadian sample of outpatients that report a prevalence of 46% (Laurin et al., 2007).

To the author's knowledge, the current study is one of only two studies to report the prevalence of anxiety in COPD outpatients in the UK, and the only study to incorporate a recognised DSM or ICD diagnosis. Another study by

Yohannes and colleagues (2000a) report a prevalence of clinical anxiety of 18% within a sample of 137 older (mean age = 73 years) COPD outpatients based on the Automatic Geriatric Examination for Computer Assisted Taxonomy (AGECAT; Copeland et al., 1986), a syndromal rather than a strict nosological classification system such as the DSM-IV-TR or ICD-10. Although Yohannes and colleagues do not report the severity of COPD among their sample, they indicate that their subjects had an FEV<sub>1</sub> of 0.89 (SD 0.3) litres, a similar level of lung function to the subjects in the current research (median = 0.87 litres).

In the current study, PD was diagnosed in 36% of patients making it the most prevalent disorder among the sample. In addition, 23% of patients were diagnosed with GAD. These findings are in line with previous studies which suggest that PD and GAD are the most common anxiety disorders in patients with COPD. Prior studies exploring the prevalence of PD indicate that it is the most common co-morbid anxiety disorder in COPD. For example, a study by Dowson et al. (2004) found that 41% of inpatients with COPD had PD. In contrast, Laurin and colleagues report the prevalence of PD in a large outpatient sample (n=116) to be 21%. Findings from the current study indicate that PD may be more prevalent in outpatients than previously reported.

The prevalence of GAD in patients with COPD appears to be higher in inpatients than outpatients. Previous studies report the prevalence of GAD among inpatients with COPD to be 10-33%, whilst studies in outpatients suggest a prevalence of 6-19% (Dowson et al., 2004; Köhl et al., 2008; Laurin et al., 2007; Yellowlees et al., 1987). As is the case with PD, findings from the current study

suggest that the prevalence of GAD among patients with COPD may be higher than previously thought. It is not clear why a higher prevalence was found in this research. Although the small sample size is likely a key factor, another influence may be the recruitment and sampling strategy used in this research. Patients were invited to participate in a study exploring anxiety, so it is possible that self-selection bias influenced recruitment (Nilsen et al., 2009). For instance, patients who had experienced anxiety may have been more likely to participate than those who had not.

Psychiatric interviews also indicated that one patient (5%) in the follow-up sample had a diagnosis of social phobia and two patients (9%) had a diagnosis of agoraphobia without a history of PD. The prevalence of social phobia in the current study is the same as found by Vögele and von Leupoldt in a sample of 20 inpatients with COPD. However, this is a lower figure than that reported by Laurin et al. (2007) who found a prevalence of social phobia of 11% in a demographically similar sample of outpatients from Canada. Again, the small sample size in the current research may be responsible for this discrepancy in findings. Laurin et al. (2007) included 116 patients in their study, whilst the current sample incorporated only 22 participants.

To the author's knowledge, this is the first study to report on the prevalence of agoraphobia without a history of PD in patients with COPD. This DSM-IV-TR diagnosis is characterised by agoraphobia and a focus of fear on the occurrence of incapacitating or extremely embarrassing panic-like symptoms or limited-symptom attacks rather than full PAs (APA, 2000). The APA (2000) suggests



that agoraphobia without a history of PD is relatively unknown and uncommon, and affects less than 2% of the general population (Andrews & Slade, 2002). A key diagnostic feature of this anxiety disorder that might explain the elevated prevalence in this sample is that individuals suffering from agoraphobia without a history of PD commonly have an associated medical condition and experience a fear of being incapacitated or embarrassed by the development of symptoms and not being able to get help (APA, 2000). Another factor that might explain the high prevalence in this sample is that this anxiety disorder is also more prevalent in older patients (Andrews & Slade, 2002).

Data from the psychiatric interviews also suggest that mood disorders were common among this sample of patients with COPD. A total of 41% (n=9) of the sample had a mood disorder with 32 % (n=7) diagnosed with current major depressive disorder. These findings are consistent with previous studies which report the prevalence of clinical depression to be 17-37% (Barr et al., 2009; Kunik et al., 2005; Laurin et al., 2007). The findings also support the assertion that clinical anxiety and mood disorders frequently co-occur. In the current research, 32% of patients had both an anxiety and a mood disorder. This is higher than that reported by both Kunik et al. (2005) and Laurin et al. (2007) who found a prevalence of co-morbid anxiety and mood disorders in patients with COPD to be 26% and 14% respectively.

#### **7.1.3.5 Characteristics of anxious patients**

Previous research exploring the influence of COPD severity on anxiety are contradictory, with some studies finding no relationship (e.g., Gudmundsson et al., 2006; Wagena et al., 2005) and others suggesting that patients with decreased lung function (especially those towards the very severe end of the spectrum) are at greater risk of anxious symptoms (Downson et al., 2001; Felker et al., 2010). Findings from the current research indicate that there was no difference in anxiety severity (both AIR and HADS-A score) when compared with COPD severity, as measured by GOLD criteria. In addition, there was no significant difference in COPD severity between cases and non-cases of clinical anxiety in patients screened with the PHQ.

It is generally accepted that sex has an influence on anxiety, both in the general population and among patients with COPD. For example, several studies have demonstrated that women with COPD are significantly more likely to have clinically relevant symptoms of anxiety than their male counterparts (DiMarco et al., 2006; Gudmundsson et al. 2006). However, findings from the current research challenge these findings. No difference in AIR and HADS-A scores were found between males and females, and men were equally as likely as women to have a clinical anxiety disorder.

The current findings also fail to support previous findings suggesting that COPD patients with anxiety are more likely to be younger (Cleland et al., 2007) and are more likely to be current smokers (Gudmundsson et al., 2006). In the

current study, patients with clinical anxiety disorders did not differ in age, smoking status and pack year smoking history. In addition, there was no difference in AIR and HADS-A scores according to smoking status and no correlation between pack year smoking history and both anxiety scales.

The current results identified an obvious negative relationship between anxiety and HRQoL and ADL function. Patients who screened positive for an anxiety disorder on the PHQ had significantly higher CAT score and significantly lower MRADL. These findings are similar to those previously reported by Cully et al. (2006) and Giardino and colleagues (2010) who suggest that anxiety is inversely associated with scores on respiratory-specific HRQoL scales.

Although it has been demonstrated that anxiety leads to worse exercise performance (Eisner et al., 2010) and worse functional ability (Kim et al., 2000) in patients with COPD, this is the first study to explore the relationship between anxiety and ADL in patients with COPD with a disease-specific scale. In the current research, scores on the MRADL, which provides an indication of functional impairment in patients with respiratory disease, were significantly lower among patients with an anxiety disorder than those without.

## 7.2 STUDY STRENGTHS AND LIMITATIONS

As several studies were undertaken as part of this thesis, the strengths and limitations of the research are discussed under three sections, each addressing a single phase of the research.

### *7.2.1 PHASE 1*

The main strength of this phase of the research was that both emic and etic perspectives were integrated to develop a novel pool of items. Previous studies have developed potential scale items by replicating items from existing scales (e.g., Zhang & Yu, 1998) or by generating new items through qualitative interviews (e.g., Rushton et al., 2011) and thus focus solely upon emic or etic perspectives. The items developed in this research were developed using both existing theory and the accounts of individuals who had experienced the phenomena in question. This development strategy, therefore, achieved one of the key goals in scale development set out by Rowan and Wulff (2007) in that the validity of the quantitative data was enhanced by being grounded in theory and real life situations.

Another strength of the qualitative study was that the purposive sampling strategy enabled the recruitment of participants with a variety of characteristics, including both males and females, and a range of ages, COPD severities and anxiety symptom severities. An associated limitation of this strategy is that the respondents were homogenous in terms of geographical location (i.e., they were residents in one part of Greater Manchester) and were mostly retired and engaging with COPD-related services such as Breath Easy support groups or PR classes. Also, the patients recruited in Phase 1 had self-reported symptoms of anxiety rather than a confirmed diagnosis. This may be considered as a limitation as it is not clear whether the participants had

experienced clinical levels of anxiety. However, scores on the HADS-A indicated that 50% of the sample had clinically significant levels of anxiety and 36% had a previously diagnosed anxiety disorder. The range of scores recorded on the HADS-A (5-18) suggest that this sample had a range of anxiety severities that may enhance the range of experiences that were discussed. Although this sample is relatively small compared to other studies who utilise emic perspectives in item development (e.g., Jones et al., 2009b; Michalak et al., 2010), data saturation was achieved, indicating that the sample was adequate and that participants in this sample experienced somewhat similar experiences of anxiety.

A further limitation of the non-probabilistic sampling strategy used in this qualitative research is that self-selection bias may have occurred. However, the aims of the current study were to elicit the experiences of individuals who had experienced anxiety and were willing to discuss their experiences. As a particularly emotive issue such as anxiety was being explored, it was felt that any participants who were willing to share their story should be given an opportunity to participate in this study. In addition, the high prevalence of undiagnosed COPD and anxiety, the stigma around mental health, the older age of patients, and the fact that the majority of patients with COPD are treated in the community setting are all potential barriers to recruitment, which indicate that this patient group could be considered what Daly and Lumley (2002) label a 'hard-to-reach group'. The relatively diversified nature of the sample and the efforts that were made to establish trust between the researcher and participants adds to the trustworthiness of this data. The credibility of the

findings was also enhanced by allowing the research team to engage in peer review and also by the use of member checking to enhance respondent validation.

A possible limitation of the literature review undertaken in Phase 1 is that not all anxiety scales were identified and reviewed. Although every effort was made to identify all relevant anxiety scales including extensive literature searching and checking with expert clinicians, it is possible that some (particularly those lesser-known) scales were missed. Additionally, scales that were not available in English were also omitted which may have excluded important instruments. Despite these potential limitations, the final pool of items was extensive (over 200 items) and covered a range of anxiety-related symptoms.

The involvement of patients and clinicians in the scale development process is an increasingly important aspect in the development of outcome measures and is a fundamental component of the FDA's guidelines on the development of PROMs (FDA, 2009). The involvement of the ERG throughout the scale development process is an important strength of this research. The ERG allowed the content and face validity of the AIR to be enhanced and also ensured that the scale was user-friendly in patients with COPD. The ERG feedback had a direct influence on the final design of the AIR, including the decision to use large and clear shaded boxes, the use of simple wording and consistent response options. This ensures that the scale can be completed by patients with varying visual acuity and by those who may be experiencing tremor or shaking (e.g., as a side-effect of COPD medication or AECOPD), or

those patients with limited dexterity. For example, some inpatients in this study were able to use bingo daubers to mark the relevant response.

The decision to develop a small pool of potential scale items in Phase 1 might be regarded as a limitation of this research. Other scale developers have incorporated significantly larger item pools. For example, Michalak and Murray established a pool of 210 items in their development of a new HRQoL measure for people with bipolar disorder. However, the size of item pool will likely have an impact upon the sample size recruited for subsequent item reduction processes. Within this research, it was felt that respondent burden should be minimised as much as possible, particularly as patients would be recruited from acute hospital settings as well as outpatient settings. A larger pool of items would have allowed items with varying wording to be tested; however, it was felt that a small item pool would allow a larger sample to be targeted in Phase 2, as the time burden for completion would be minimised. Also, issues regarding item wording and structure were resolved using the input of the ERG and pilot respondents.

### *7.2.2 PHASE 2*

Perhaps the most obvious limitation in Phase 2 of this research is the size of the sample. As has been discussed in sections 3.5.3.1 and 3.5.3.2 on statistical tests for scale development, minimum sample sizes for both item and factor analysis are a contentious issue. However, it is generally accepted that although successful analysis can be undertaken on smaller samples, at least 100

participants are recommended (Costello & Osbourne, 2005; Fabrigar et al., 1999; MacCallum et al., 1999). Although the current sample of 88 respondents is below the recommended minimum according to most guidelines, there are several indicators that the sample size for Phase 2 was acceptable. According to Fabrigar et al. (1999) and MacCallum and co-workers (1999), successful EFA can be conducted on smaller samples providing they demonstrate certain characteristics including overdetermined factors ( $>4:1$ ), high ratios of respondents to variable ( $>5:1$ ) and high communalities (mean  $>0.7$ ). In the current study the two tests exploring the suitability of the data for EFA (KMO and Bartlett's test of sphericity) were favourable. Also, factors were overdetermined at a ratio of 16:1 and ratio of respondents to variable were 5.5:1. Finally, although communalities for the final 10-items did not quite meet recommended levels (averaging 0.67), they were still high suggesting a high degree of shared variance between the items.

Another potential limitation of Phase 2 is that the response rate was relatively low (56.4% overall). The representativeness of the sample may have been limited as almost half of the sample approached were not sufficiently motivated to participate in the research. In addition, demographic characteristics of the sample were not recorded in any detail due to time and data confidentiality constraints. Therefore, it is difficult to establish whether the sample is representative, or whether sampling bias occurred. Nevertheless, the sample did include a mix of both acutely ill inpatients and stable outpatients, roughly equal numbers of males and females, and participants with a range of ages.



The inclusion and exclusion criteria may have also had an impact upon the representativeness of the sample. For example, patients with other major co-morbidities were not eligible to participate, which may have excluded a large proportion of patients. Recent findings that have explored the prevalence of co-morbidities among hospitalised patients with COPD indicate that 77% may have an additional significant medical condition (Royal College of Physicians, British Thoracic Society & British Lung Foundation, 2008). Therefore, it is likely that a significant number of patients were ineligible to participate in this research.

Finally, a key strength of Phase 2 is that robust item and factor analytical procedures were utilised during scale refinement. Firstly, EFA was undertaken as opposed to PCA. Costello and Osbourne (2005) assert that EFA is a preferred procedure to PCA as it explores the latent structure of the data rather than merely reducing the data into manageable groups. PCA is also thought to overestimate values of variance when compared to EFA. Phase 2 also utilised ML extraction, which is suggested to be the most reliable factor extraction method (Costello & Osbourne, 2005; Fabrigar et al., 1999). Finally, the number of factors retained was determined using two different approaches to ensure an unambiguous factor solution. Although, eigenvalues  $>1$  are often the preferred option for many researchers, the current research utilised this approach in combination with the more robust scree test as recommended in current EFA guidelines (Costello & Osbourne, 2005).

### 7.2.3 PHASE 3

As is the case in Phase 2, a limitation of Phase 3 may be the representativeness of the sample. Alongside the potential for patients to be excluded due to ineligibility, this study had a very low response rate among patients under the care of the ARAS nursing team. There is no clear reason why this may have occurred; however, a number of factors may have played a part. First, the patients were approached by an invitation letter, which was sent according to database records. It was evident from the high number of letters returned by Royal Mail (6%) that many of the addresses were out of date. Second, it is possible that many patients simply did not wish to engage in COPD-related research, particularly if they believed that their lung disease was not a key factor in their lives (i.e., other co-morbidities or life events may be prioritised above COPD). Third, there is the potential that the stigma associated with mental health resulted in patients not wishing to participate in anxiety-related research (Woodall et al. 2010). Finally, although the author was informed that several of the patients on the records had deceased since the database had last been updated, it is possible that other records were out of date.

Although a number of factors may have influenced the response rate of this study to some extent, such a low response rate indicates that the vast majority of potential participants were not motivated to take part in this research. One additional factor that may have played a key role in participant motivation is the fact that there was no incentive to participate in this research. Anecdotal evidence collected by the author suggests that patients who had participated in

previous research had received compensation for their time and effort (usually money or vouchers). Providing incentives has been shown to increase participant rates in research (e.g., Onwuegbuzie, 2000) and may also enhance the care and attention that participants put into their responses (Weems et al., 2003). Therefore, the lack of incentives in the current research might help to explain the extremely low response rates in this particular sample of patients. It is worth noting, however, that incentives may have a detrimental effect in terms of biasing responses and should be carefully selected to avoid the possibility of any coercion (Grant & Sugarman, 2004; Weems et al., 2003)

In contrast to the ARAS sample, the response rate for participants from PR classes was considerably higher. Once again, it is unclear why this might be. Some insight is provided by Halding and colleagues (2010) who suggest that patients attending PR have a collective sense of belonging that promotes engagement, confidence and motivation. This feeling of belonging may have influenced patients' willingness to participate in this research. Alternatively, the presence of clinicians during the PR classes may have had a 'white coat' effect on patients which motivated them to participate (Merz et al., 2002).

An important strength of Phase 3 was that psychiatric assessment was undertaken by a blinded researcher to establish caseness of clinical anxiety disorders. This allowed the screening properties of the AIR to be compared against the gold standard diagnostic criteria. Other studies have established the clinical utility of screening tools through comparison with other screeners or scales. For example, Kunik et al. (2007) explored the screening properties of the

shortened PRIME-MD by comparing it with the BAI. Although this allows large samples to be incorporated (due to reduced participant burden), the validity of this approach is severely limited by not incorporating a criterion diagnostic measures such as DSM-IV-TR and ICD-10. Although the current research incorporated a psychiatric diagnosis, it also utilised the PHQ as a second criterion measure. Although the PHQ has excellent documented accuracy as a screener for anxiety disorders (Diez-Quevedo, 2001; Löwe et al., 2003), the dependence upon this scale for establishing aspects of the AIR's clinical utility may be seen as a potential limitation of the current research.

Whilst there is some disagreement as to which of the two psychiatric classification systems is preferred, the DSM-IV (which is virtually identical to DSM-IV-TR in terms of anxiety classification) appears to be more popular among mental health professionals worldwide (Andrews et al., 1999). This may be because although the ICD-10 is a global classification system, the DSM-IV-TR (originating in the USA) contains additional detail which is unlikely to ever be included in future versions of the ICD (American Psychological Association, 2009). Thus, the current research is strengthened by the potential for findings to be interpreted globally.

One drawback of incorporating a psychiatric assessment is that it is often difficult to recruit large numbers of participants. In the current study, less than half of the original participants underwent psychiatric interview. Many participants did not originally consent to psychiatric assessment and others withdrew their consent. Although it is not possible to determine the reasons for

this low consent rate, it is possible that this is due to the stigma associated with mental health and psychiatry in particular, and the time-consuming nature of the interview. There is also the potential for a sampling bias to be present as participants were consenting volunteers rather than chosen randomly from a wider sample. In other words, those patients who experienced anxiety may have been more likely to volunteer to participate compared to patients without anxiety.

As has been discussed in the previous section (7.3.2), sample size can have an important effect on the accuracy of CFA procedures. The sample of 56 patients recruited in Phase 3 is significantly lower than the recommended minimum of 100 participants endorsed by Kline (2005) to ensure reliable CFA can be undertaken. However, the ratio of participants to parameters (5.6:1) exceeded that recommended by Worthington & Whittaker (2006), indicating that the sample may be adequate for CFA. As discussed previously in relation to the validity of the AIR (section 7.2.3.1), a larger sample would have also had the advantage of minimising the negative influence that sample size can have on some indices of fit (Miles & Shevlin, 1998).

Although there was little missing data for outcome measures in Phase 3, data were unavailable for several participant characteristics. In particular, there were missing data for both smoking status and smoking history, which may limit findings relating to the relationship between smoking and anxiety. Several participants did not wish to disclose whether they were current smokers and some individuals could not recall, or chose not to disclose their pack year

smoking history. It is therefore likely that the smoking status and smoking history figures may be distorted, presumably underreporting both the prevalence and history of smokers.

A potential limitation and ethical issue of this study is that in completing a self-report measure which asks questions about anxiety, there is the possibility that this induced anxiety by prompting memory of past anxiety experiences.

Although, it was not possible to assess objectively whether the AIR induced anxiety in the current study, a recent study by Humphris et al. (2006) exploring whether completing a questionnaire about dental anxiety increased anxiety found that completion of the questionnaire had no significant effect on state anxiety. The potential for the AIR to induce anxiety in this study was acknowledged as a potential ethical issue. However, anecdotal evidence indicated that patients reported that taking part in both interviews and scale completion was a positive experience and that they appreciated the opportunity to have their voice heard, even if it involved recalling difficult experiences. This finding is supported by work by Humphris and co-workers who assert that the completion of an anxiety scale can decrease the state anxiety of dental patients (Humphris et al. 2006). In order to minimise the distress experienced by the participants in the current study, it was emphasised that clinical support (via a GP or recruiting clinician) would be available after the study should any participants wish to discuss distress experiences as a result of the study.

Although this research incorporated several well-validated outcome measures including the CAT, PHQ and MRADL, it is possible that these somewhat brief

self-report scales do not provide a comprehensive assessment of these outcomes. Of particular note is the use of the CAT which contains only eight items relating to HRQoL. In comparison, a more traditional scale such as the SGRQ contains 76 HRQoL-related items covering three domains: symptoms, activity and impacts. Although the CAT is certainly less detailed than the SGRQ, recent data indicate that the CAT is a comparable outcome measure. Ringbaek et al. (2012) report a high correlation ( $r=0.73$ ) between the two measures within a sample of 90 COPD patients who were undergoing PR. The authors also suggest that in addition to speed of completion, the CAT is considerably easier to complete. A total of 86.5% of patients in Ringbaek and colleague's study needed assistance in completing the SGRQ compared to 53.9% completing the CAT.

A further limitation of the current research is although the reliability and validity of the AIR were examined in detail, the sensitivity to change was not explored and therefore it is difficult to recommend the AIR for use as an a temporal measure in research settings. Recommendations regarding future research (section 8.4) discuss this in more detail.

In light of the cognitive theories of anxiety discussed in Chapter 2, it is important to note that this thesis did not explore the coping styles of the research participants. As Lewis et al. (2012) assert, if defensiveness measures are not included when measuring self-reported anxiety, then repressors will be classed as low-anxious and defensive high-anxious patients will be classed as high-anxious. This may have important implications on both the identification

of patients with clinically relevant levels of anxiety and the subsequent management of these individuals.

In terms of detecting PD and GAD, it is possible that patients who might be classed as repressors were not identified in this study as high anxious, as their self-reported anxiety may not reflect their true anxiety (i.e., they might be considered self-deceivers). Previous research suggests that the repressive coping style is common in patients with chronic disease, particularly among chronic respiratory diseases such as asthma and lung cancer (Prasertsri et al. 2011, Gonzalez-Freire et al. 2010). Approximately one quarter of patients in the studies by Gonzalez-Freire and colleagues (2010) and Prasertsri and co-workers (2011) were identified as repressors. Although no studies have specifically explored the prevalence of the repressive coping style in patients with COPD, the clinical and demographic characteristics of Prasertsri and co-workers' sample of patients with lung cancer were very similar to those found in the current research. This would suggest that approximately 25% of patients in the current research might be considered as repressors and thus not identified as highly anxious by the AIR. It is important to remember that these individuals are not merely in denial, but genuinely believe that they are well-adjusted, self-controlled, and content and are likely to seem healthy on all self-report measures of mental health (Weinberger, 1990).

Although it is difficult to predict whether patients in this study were repressors (high-defensiveness and low anxiety), the narratives of interview respondents suggest that at least one group of research participants had high levels of self-



reported anxiety. Myers and Brewin (1996) assert that when asked of their life experiences, repressors are likely to report more positive events and fewer negative events as compared to nonrepressors. The narratives of the patients interviewed (during the qualitative phase of research) in the current study indicate that they were highly anxious and so might be classed as defensive high anxious (high anxiety and high defensiveness) or high anxious (Weinberger, Schwartz and Davidson, 1979). Other studies have found high proportions of defensive high anxious patients in populations of patients with chronic lower back pain and chronic fatigue syndrome (Creswell & Chalder, 2001; Lewis et al. 2012). It is important to consider that this research utilised three separate samples of patients, so the experiences of the qualitative sample do not indicate that all patients in sample 2 and 3 were high anxious. Conversely, it is possible that Phase 2 and 3 samples had a low number of repressors due to self-selection bias. For example, Lewis and colleagues (2012) suggest that the low numbers of repressors identified in their study of patients with lower back pain may be because repressors are less willing to seek or accept treatment and participate in research studies. In order to fully understand the coping styles of individuals with COPD, a validated instrument such as the Marlow-Crowne Social Desirability Scale (Crowne & Marlowe, 1964) could be utilised, and this may be an important future direction of further research.

Identification of coping style within COPD populations may have important implications for the management of anxiety as this will enable clinicians to put in place appropriate management strategies for patient with this condition. Repressors, for example, may respond better to interventions where they

maintain a greater feeling of personal control; they may also be reluctant to engage in psychotherapy (Phipps & Steele, 2002). This group may also be more comfortable with low levels of information about their disease, as higher levels result in information overload and increases in arousal. However, high anxious individuals may do better when provided with additional information that may act to lower an individual's anxiety (Shaw et al. 1986). Thus, the management of PD or GAD in patients with a repressive coping style may need to be tailored accordingly. In the context of the vigilance-avoidance theory which explains the cognitive biases around the repressive coping style, it is understood that avoidance maintains anxiety as it prevents an individual from evaluating non-threatening stimuli sufficiently to perceive that they are not threatening and therefore exposure to the stimulus is insufficient to allow habituation (Derakshan et al. 2007). To support modification of these cognitive biases, there is growing evidence to support the role of cognitive therapies such as CBT in supporting changes in attentional biases and ameliorating anxiety (Derryberry & Reed, 2002; Amir & Taylor, 2011 ; Emmelkamp, 2012).

## Chapter 8 : SUMMARY, IMPLICATIONS, RECOMMENDATIONS AND CONCLUSIONS

### 8.1 INTRODUCTION

The following chapter presents a summary of findings from the current research. Following this, the potential implications of these findings for both theory and practice are explored and, finally, considerations for further study will be discussed.

### 8.2 SUMMARY

The overall aim of this research was to develop a non-somatic anxiety scale that can be used as a marker of anxiety in patients with COPD and screen for the two common anxiety disorders of GAD and PD. In the following section a summary of the research findings related to the objectives outlined in section 1.6 are presented.

#### *8.2.1 FINDINGS RELATING TO RESEARCH OBJECTIVES*

1. The experiences of anxiety in patients with COPD were explored in a sample of 14 participants. The findings suggest that symptoms of anxiety were often confused with those of COPD and the side-effects of medications. The findings also enhanced the understanding of the

relationships between anxiety and breathlessness. Patient-reported non-somatic symptoms of anxiety were compared with those in extant scales and 16 novel items were developed that reflected symptoms of GAD and PD.

2. ERG involvement guided the development of a draft version of the AIR, which had a clear layout, a consistent response set and good face validity. 88 patients with COPD completed the draft AIR and six items were excluded from the draft AIR based on strict item and factor analytical procedures. The final version of the AIR had a clear single-factor structure and excellent internal consistency.
3. The AIR was completed by a clinical sample of outpatients with COPD. The findings suggest that the scale has excellent temporal stability and provide further evidence to support the excellent internal consistency of the AIR. The findings demonstrated that the AIR had high convergent validity with the HADS-A and was able to discriminate between patients with and without clinical anxiety disorders, thus demonstrating known-groups validity. CFA indicated that the best model fit for the AIR was a two-factor solution of panic and general anxiety. Three scores can be calculated from the AIR: a panic score (5 items) and a general anxiety score (5 items) and a total anxiety score. The AIR was able to accurately screen for anxiety disorders and sub-scores for the AIR-panic and AIR-general anxiety demonstrated clinical utility in screening specifically for PD and GAD.

### 8.3 IMPLICATIONS OF FINDINGS

Findings from this research have implications for both theory and practice.

First, these findings demonstrate that the AIR is a short, user-friendly, reliable and valid self-report scale that can be used as a marker of anxiety and to screen for anxiety disorders in patients with COPD. Existing COPD guidelines have highlighted the need for a disease-specific anxiety scale which can be used to screen for anxiety disorders in clinical practice. The AIR is the first COPD-specific scale which reliably assess markers of anxiety in this population and can therefore be recommended for use in clinical and research settings.

Co-morbid anxiety disorders are common in patients with COPD, yet are often unrecognised. The AIR demonstrates excellent screening properties for the two most common anxiety disorders in COPD patients: PD and GAD. Although further research is needed to confirm the screening utility of the AIR for specific PD and GAD diagnoses, there is promising evidence that the sub-scores of the scale may be used as additional screening indicators for the two anxiety disorders. In the meantime, it is recommended that the total score of the AIR be used to screen for the presence of clinical anxiety disorders.

This study also compared the screening properties of the AIR and the HADS-A (the most commonly used anxiety scale in COPD research and practice) and found that the AIR had superior clinical utility for the detection of anxiety disorders, particularly PD. Therefore, these findings indicate that the AIR is a valid (and potentially superior) alternative to the HADS-A for screening anxiety

in this population. Unlike other extant scales used in patients with COPD, the AIR was also designed in collaboration with patients and clinicians, which supports its validity and usability in COPD-related clinical practice. The development and validation of the AIR is in accord with recommendations set out by the FDA (2009) which ensure that the scale is also a valid outcome measure for research settings. Its brief completion time and clear format further support the efficacy of the AIR for use in patients with COPD.

Findings from the qualitative phase of this research compliment current understanding on co-morbid anxiety in patients with COPD. Alongside exploring the most relevant anxiety symptoms, which helped to conceptualise the AIR, the accounts of patients with COPD also provide the first in-depth insight into their experiences of anxiety. These findings provide additional evidence for the confusion that exists between somatic symptoms of anxiety and those of COPD. In particular, the accounts of these participants suggest that symptoms such as breathlessness, palpitations and shaking are readily confused by patients who may consider them to be side-effects of their medication or merely a symptom of their COPD. This has implications on practice and suggests that a focus on non-somatic symptoms might be employed by clinicians. It also indicates that patients may require additional time and support in learning to recognise and manage their own symptoms.

These findings also add to the emerging theory exploring the relationships between dyspnoea and anxiety. Specifically, they suggest that anxiety might be both a sign and a cause of breathlessness in patients with COPD. This may have

implications on the management of co-morbid anxiety in this patient group. For example, strategies for managing PD, PA or sub-clinical symptoms of panic may be more suitable if focussed on the cognitive aspects of panic, rather than primarily addressing the somatic symptoms. This provides support for the role of CBT and other psychotherapies in managing anxiety in patients with COPD. In addition, these qualitative data also indicate that self-management, particularly self-talk strategies are simple yet effective cognitive management techniques that, to date, have received little focus within the COPD literature.

#### 8.4 RECOMMENDATIONS FOR FUTURE RESEARCH

Scale development is an on-going process, particularly in terms of establishing validity, which depends on the collation of empirical evidence to support the conceptual model of a scale (Robins et al., 2001). At the heart of these recommendations is the need to continue to establish and confirm the psychometric properties of the AIR in clinical populations. Therefore, this research should be replicated across samples with different ages, cultures and geographical locations, with a particular focus upon the utility of the AIR to screen for clinical anxiety disorders. The importance of a gold standard criterion measure cannot be underestimated and future studies should endeavour to incorporate psychiatric diagnoses in larger patient samples. The inconsistent cut-off scores found in the current research indicate that further research is warranted to establish the optimal cut-off score in patients with COPD. Furthermore, in light of the cognitive theories of anxiety discussed previously, particularly the role of defensiveness in confounding the

identification of patients with high anxiety, it is recommended that a validated social desirability measure such as the Marlow-Crowne Social Desirability Scale (Crowne & Marlowe, 1964) is used in future studies to fully understand the prevalence of repressive coping within this population. This may give an important insight into the true ability of the AIR to detect anxiety in patients with COPD.

Further research should also be undertaken to translate and validate the AIR in languages other than English. The ability to be transferable across different languages is an important goal for an outcome measure, particularly in research settings. However, Keedwell and Snaith (1996) highlight that this may prove to be problematic for anxiety scales as anxiety has a variety of meanings and manifestations in different languages. For example, although the terms derive from a common root, the English term anxiety does not cover the same semantic space as the French *anxiété* or the Spanish *ansiedad*. The French term *angoisse* or anguish emphasises physical symptoms, whilst the German term *angst* is a more general emotion (Keedwell and Snaith, 1996).

Another recommendation is to examine and re-affirm other aspects of the AIR's reliability and validity. In particular, further research should be conducted to investigate the sensitivity of the AIR to detect change in anxiety severity. This can be achieved by incorporating the AIR as an outcome measure for anxiety in trials exploring management interventions for anxiety (e.g., PR programmes or CBT interventions). This will also allow the minimum important difference of the AIR to be calculated by comparing scores over time between treatment



groups. This would enhance the utility of the AIR as an outcome measure for clinical research (FDA, 2009). Also, the inconsistency in factor structure between Phase 2 and 3 in the current research emphasises the need for further CFA on larger clinical samples. The influence of sample size on fit indices means that it is difficult to reach firm conclusions on the factor structure of the AIR based on findings from the current research. Therefore, further analyses in samples of >200 patients are worthy of endeavour. Finally, although this research established the temporal stability of the AIR over a 2-week period, future studies should be undertaken to explore the test-retest reliability of the scale at longer intervals e.g., 3 months, 6 months and 1 year.

Future research might also explore the utility and psychometric properties of the AIR in other clinical populations. Although the AIR was designed specifically for patients with COPD, the conceptual non-somatic nature of the scale indicates potential validity in patients with other respiratory diseases and even in other chronic diseases that are characterised by an emphasis on somatic symptoms. Of course, instruments developed for a particular population may not be valid in other groups and therefore specific validation, including item analysis and FA is recommended (FDA, 2009; National Institute of Health, 1998).

Additional studies are also needed to confirm the variability of scores on the AIR. The findings in the current research indicate that scores might be positively skewed, which questions the ability of the AIR to distinguish between patients with a full spectrum of anxiety severities. Therefore, studies should be undertaken to establish whether this is the case in larger representative

samples. If non-normal distribution of scores remains, then the response set of the AIR may need to be widened or the wording amended. Studies that incorporate cognitive debriefing may aid in this process.

Finally, further research should be undertaken to explore the experiences of patients with COPD and anxiety in more detail. In particular, qualitative studies exploring the experiences of patients with diagnosed anxiety disorders are worthy of endeavour. It is likely that patients with PD, GAD and other anxiety disorders have differing experiences and these accounts may aid our understanding of why patients with COPD experience an elevated prevalence of anxiety and help to optimise or tailor the management of these co-morbid disorders.

## 8.5 CONCLUSIONS

This thesis aimed to develop a novel non-somatic anxiety scale which can be used as a marker of anxiety and screener for anxiety disorders in patients with COPD. The results of the current research affirm the need for a non-somatic scale and provide strong evidence for the reliability and validity of the newly developed AIR.

The qualitative findings from this research provide the first insight into the unique experience of anxiety from the COPD patients perspective and suggest that anxiety and panic can have a profound impact emotionally. The accounts of participants with COPD confirm that somatic symptoms of anxiety are readily

confused with those of the disease and medications and support the conceptualisation of a non-somatic anxiety scale. The findings also aid our understanding of the complex relationships between breathlessness and anxiety and highlight patients' anxiety management strategies.

The three phases of research presented in this thesis demonstrate the robust development of the novel AIR scale which has been specifically designed for use in patients with COPD. The synthesis of emic and etic perspectives and the integration of an ERG ensure that the AIR has good content and face validity, and is user-friendly by being quick to complete, easy to understand and complete, and meaningful to patients.

Although further validation is certainly required, these findings indicate that the AIR is able to accurately identify patients with clinical anxiety disorders, particularly the two common disorders of PD and GAD. The scale appears to perform as well, if not better, than the HADS-A as a screening tool for anxiety in patients with COPD and the high sensitivity values indicate that the AIR is able to maximise false positives and minimise false negatives.

The AIR can be recommended as an accurate and user-friendly screening tool for anxiety disorders and reliable and valid outcome measure for anxiety severity in patients with COPD. Future study should further explore the reliability and validity of the AIR in larger representative samples and confirm the ability of the AIR to specifically screen for GAD and PD. Further assessment of coping styles within this population is also warranted in order to fully

understand the accuracy of this tool in identifying anxiety using self-report. Finally, the utility of the AIR in other chronic respiratory populations and possibly other chronic diseases is also worthy of further research.

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## APPENDICES

### Appendix 1: NHS Research Ethics Committee study approval

**NHS**

**National Research Ethics Service**  
**North West 12 Research Ethics Committee - Lancaster**  
Barlow House  
3rd Floor  
4 Minshull Street  
Manchester  
M1 3DZ  
Telephone: 0161 625 7818  
Facsimile: 0161 237 9427

15 June 2010

Mr Thomas Willgoss  
PhD student  
Manchester Metropolitan University  
Elizabeth Gaskell Campus  
Hathersage Road  
Manchester  
M13 0JA

Dear Mr Willgoss

**Study Title:** The development and validation of a novel scale to screen and measure anxiety in patients with Chronic Obstructive Pulmonary Disease (COPD)

**REC reference number:** 10/H1015/41

**Protocol number:**

Thank you for your letter of 4 June 2010, responding to the Committee's request for further information on the above research and submitting revised documentation.

The further information was considered in correspondence by a sub-committee of the REC. A list of the sub-committee members is attached.

**Confirmation of ethical opinion**

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation as revised, subject to the conditions specified below.

**Ethical review of research sites**

The favourable opinion applies to all NHS sites taking part in the study, subject to management permission being obtained from the NHS/HSC R&D office prior to the start of the study (see "Conditions of the favourable opinion" below).

**Conditions of the favourable opinion**

The favourable opinion is subject to the following conditions being met prior to the start of the study.

Management permission or approval must be obtained from each host organisation prior to the start of the study at the site concerned.

For NHS research sites only, management permission for research ("R&D approval") should be obtained from the relevant care organisation(s) in accordance with NHS research

This Research Ethics Committee is an advisory committee to North West Strategic Health Authority

*The National Research Ethics Service (NRES) represents the NRES Directorate within the National Patient Safety Agency and Research Ethics Committees in England*

governance arrangements. Guidance on applying for NHS permission for research is available in the Integrated Research Application System or at <http://www.rdforum.nhs.uk>. Where the only involvement of the NHS organisation is as a Participant Identification Centre, management permission for research is not required but the R&D office should be notified of the study. Guidance should be sought from the R&D office where necessary.

Sponsors are not required to notify the Committee of approvals from host organisations.

The Sub-committee gave a favourable opinion with the condition that the CI adds the contact telephone number to the complaints procedure.

**It is the responsibility of the sponsor to ensure that all the conditions are complied with before the start of the study or its initiation at a particular site (as applicable).**

**You should notify the REC in writing once all conditions have been met (except for site approvals from host organisations) and provide copies of any revised documentation with updated version numbers.**

#### Approved documents

The final list of documents reviewed and approved by the Committee is as follows:

Document	Version	Date
Covering Letter		22 April 2010
REC application	2.5	23 April 2010
Protocol	1.1	20 April 2010
GP/Consultant Information Sheets	1.1	20 April 2010
GP/Consultant Information Sheets	1.1	20 April 2010
GP/Consultant Information Sheets	1.1	20 April 2010
Evidence of insurance or indemnity		21 April 2010
Letter from Sponsor		21 April 2010
Interview Schedules/Topic Guides	1.1	21 April 2010
Questionnaire: HADS		
Questionnaire: MRADL		
Questionnaire: CAT		
Flowchart	1.1	20 April 2010
Investigator CV		
academic supervisor CV		
Covering Letter		04 June 2010
Participant Information Sheet: For phase 1 interviews - clean	2.1	02 June 2010
Participant Information Sheet: For phase 1 interviews - tracked	2.1	02 June 2010
Participant Information Sheet: Phase 2 item analysis - clean	2.1	02 June 2010
Participant Information Sheet: Phase 2 item analysis - tracked	2.1	02 June 2010
Participant Information Sheet: Phase 3 scale validation - clean	2.1	02 June 2010
Participant Information Sheet: Phase 3 scale validation - tracked	2.1	02 June 2010
Participant Consent Form: For phase 1 interviews - clean	2.1	02 June 2010
Participant Consent Form: For phase 1 interviews - tracked	2.1	02 June 2010
Participant Consent Form: Phase 2 item analysis - clean	2.1	02 June 2010
Participant Consent Form: Phase 2 item analysis - tracked	2.1	02 June 2010
Participant Consent Form: Phase 3 scale validation - clean	2.1	02 June 2010

Participant Consent Form: Phase 3 scale validation - tracked	2.1	02 June 2010
Response to Request for Further Information		

#### Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees (July 2001) and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

#### After ethical review

Now that you have completed the application process please visit the National Research Ethics Service website > After Review

You are invited to give your view of the service that you have received from the National Research Ethics Service and the application procedure. If you wish to make your views known please use the feedback form available on the website.

The attached document "*After ethical review – guidance for researchers*" gives detailed guidance on reporting requirements for studies with a favourable opinion, including:

- Notifying substantial amendments
- Adding new sites and investigators
- Progress and safety reports
- Notifying the end of the study

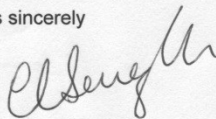
The NRES website also provides guidance on these topics, which is updated in the light of changes in reporting requirements or procedures.

We would also like to inform you that we consult regularly with stakeholders to improve our service. If you would like to join our Reference Group please email [referencegroup@nres.npsa.nhs.uk](mailto:referencegroup@nres.npsa.nhs.uk).

10/H1015/41

Please quote this number on all correspondence

Yours sincerely

  
Dr Lisa Booth  
Chair

Email: [carol.ebenezer@northwest.nhs.uk](mailto:carol.ebenezer@northwest.nhs.uk)

Enclosures: *List of names and professions of members who were present at the meeting and those who submitted written comments*

"After ethical review – guidance for researchers"

Copy to: *Professor Valerie Edwards-Jones*  
*Steve Woby*



## National Research Ethics Service

NRES Committee North West - Lancaster

Barlow House  
3rd Floor  
4 Minshull Street  
Manchester  
M1 3DZ

Tel: 0161 625 7830

11 April 2011

Mr Thomas Willgoss  
PhD student  
Manchester Metropolitan University  
Elizabeth Gaskell Campus  
Hathersage Road  
Manchester  
M13 0JA

Dear Mr Willgoss

**Study title:** The development and validation of a novel scale to screen and measure anxiety in patients with Chronic Obstructive Pulmonary Disease (COPD)  
**REC reference:** 10/H1015/41  
**Amendment number:**  
**Amendment date:** 01 April 2011

### Overview of Amendment

Request to substitute the use of the HAD scale for the GAD- and the PHQ-PD during the 3rd phase of the project.

Request to improve validity of the research during 3<sup>rd</sup> phase of the project with a small sample of participants selected to undergo a short clinical interview.

Amendment to both 2nd and 3rd phases of data collection to reduce minimum time needed to give informed consent from 48 hours to 24 hours.

The above amendment was reviewed on 11 April 2011 by the Sub-Committee in correspondence.

### Ethical opinion

The members of the Committee taking part in the review gave a favourable ethical opinion of the amendment on the basis described in the notice of amendment form and supporting documentation.

### Approved documents

The documents reviewed and approved at the meeting were:

Document	Version	Date
PHQ-PD/GAD-7		
Participant Consent Form	3.2	17 March 2011

This Research Ethics Committee is an advisory committee to the North West Strategic Health Authority  
The National Research Ethics Service (NRES) represents the NRES Directorate within  
the National Patient Safety Agency and Research Ethics Committees in England



Participant Information Sheet	3.2	17 March 2011
Protocol	2.2	17 March 2011
Notice of Substantial Amendment (non-CTIMPs)		01 April 2011
Covering Letter		01 April 2011

#### **Membership of the Committee**

The members of the Committee who took part in the review are listed on the attached sheet.

#### **R&D approval**

All investigators and research collaborators in the NHS should notify the R&D office for the relevant NHS care organisation of this amendment and check whether it affects R&D approval of the research.

#### **Statement of compliance**

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees (July 2001) and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

10/H1015/41:	Please quote this number on all correspondence
--------------	--

Yours sincerely

11 

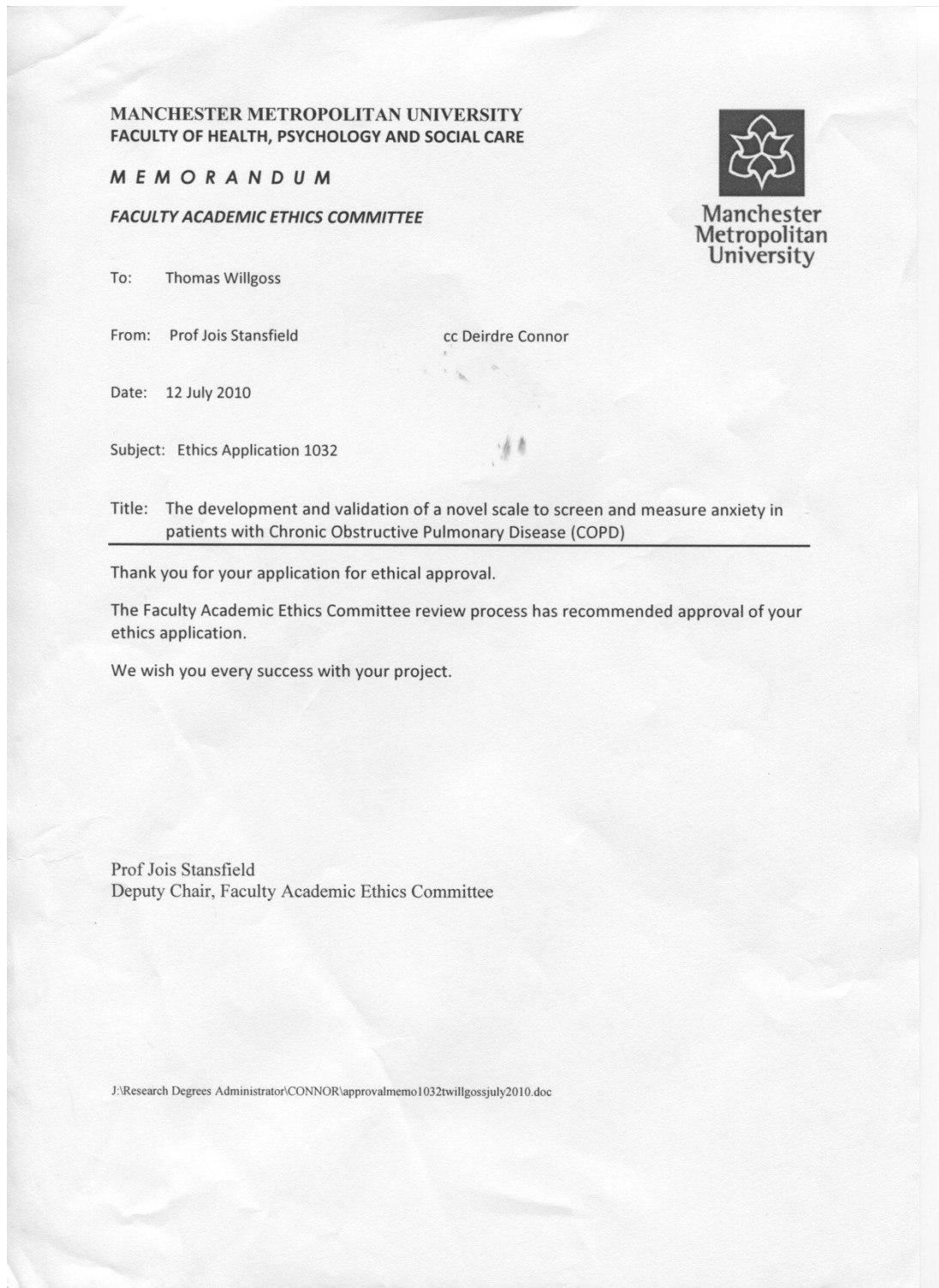
**Dr Lisa Booth**  
**Chair**

E-mail: rowen.callaghan@northwest.nhs.uk

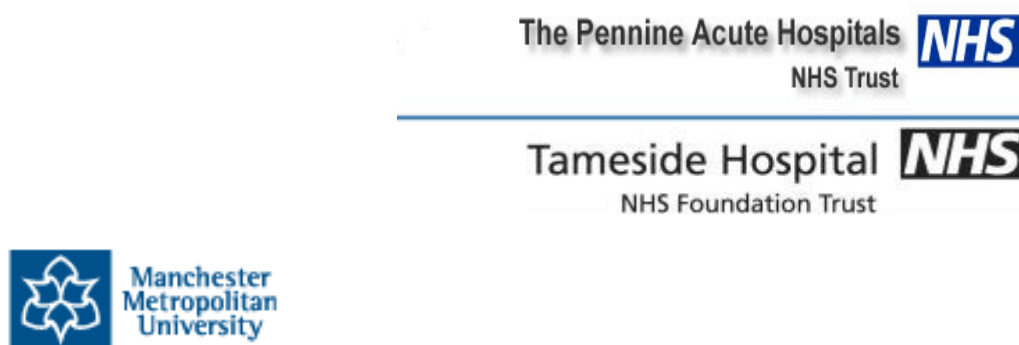
*Enclosures:*                      *List of names and professions of members who took part in the review*

*Copy to:*                          *Professor Valerie Edwards-Jones*  
   *Steve Woby*

## Appendix 2: MMU Faculty of Health, Psychology and Social Care Academic Ethics Committee study approval



### Appendix 3: Example GP information sheet



Department of Health Professions  
Manchester Metropolitan University  
Elizabeth Gaskell Campus  
Hathersage Road  
Manchester  
M13 0JA  
Tel: 0161 247 2610  
Thomas.g.willgoss@stu.mmu.ac.uk

Date:

#### **GP INFORMATION SHEET- Phase 2 Item analysis (Version 1.1 20/04/10)**

**Title of project: The development and validation of a novel scale to screen and measure anxiety syndrome in patients with Chronic Obstructive Pulmonary Disease (COPD)**

Principal researcher: Thomas Willgoss  
Your patient:  
Address:  
D.O.B:

Has participated in the above research study.

This research has three objectives:

1. To investigate how people with COPD experience anxiety and anxious symptoms.
2. To design a new COPD-specific anxiety scale which is simple to administer and complete.
3. To test if the new scale is reliable and valid.

Participants completed a draft version of the COPD anxiety scale so that statistical analysis can be carried out to refine scale items.

We wish to inform you that your patient has completed the draft scale on [date]. Although the scale is yet to be validated, their responses indicate that they may have been experiencing high levels of anxiety. Your patient has consented for us to contact you if we feel that their anxiety levels are high. We hope that this information will enable you to explore this matter as you see fit.

If you have any questions about this research please do not hesitate to contact me.

Kind regards,

Thomas Willgoss



## Appendix 4: Phase 1.2 Patient Information Sheet



Department of Health Professions  
Manchester Metropolitan University  
Elizabeth Gaskell Campus  
Hathersage Road  
Manchester  
M13 0JA

Date:

### **PARTICIPANT INFORMATION SHEET- Phase 1 Interviews (Version 2.1, 02/06/10)**

**Title of project: The development and validation of a novel scale to screen and measure anxiety syndrome in patients with Chronic Obstructive Pulmonary Disease (COPD)**

You are being invited to take part in a research study which is being undertaken as part of the researcher's PhD. Before you decide if you wish to take part it is important for you to understand why the research is being done and what it will involve. Please read this information carefully and talk it through with someone else if you wish. Also, please ask us if there is anything that is not clear or if you would like more information.

Thank you for reading this.

### **What is the purpose of the study?**

Previous research has found that patients with COPD often suffer with anxiety which can lead to a poorer quality of life and increased hospital visits. However, we do not know how common this problem is. One of the problems with detecting anxiety in patients with COPD is that at the moment, there is no specific tool to identify anxiety. Existing scales are designed for the general public and therefore do not take into account how people with COPD experience anxiety. Research has found that many of the symptoms of anxiety overlap with symptoms of COPD, making it difficult to tell the difference between the two. We are planning to design

a new scale to detect anxiety specifically in patients with COPD. This scale will be easy to complete and may help medical professionals identify people who may need further help.

This research has three objectives:

4. To investigate how people with COPD experience anxiety.
5. To design a new anxiety scale which is simple to complete.
6. To test if the new scale is reliable and valid.

### **Why have I been chosen?**

We are hoping to recruit and interview 18 patients in Greater Manchester with COPD who can help us to understand what it is like to live with COPD and anxiety.

### **Do I have to take part?**

No, taking part is voluntary. This is a research study and it is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you take part you are still free to stop at any time without giving reason. This will not affect the standard of care you receive.

### **What will happen to me if I take part?**

You will be asked to complete an interview (taking up to 1 hour) at a time that is convenient to you. Interviews will be carried out at your home but another location can be arranged if you wish e.g. at the hospital. The interview will be conducted by the researcher (Thomas Willgoss) who will ask questions about your experiences of living with COPD and anxiety. The interviewer will also ask you a few questions about you and your lifestyle (age, if you are a smoker etc). You are free to stop the interview and recording at any time you wish. Also, if you feel out of breath during the interview and require a break then this can be arranged. If you become very breathless then the interviewer will be happy to return on another occasion and resume the interview. We will also ask you to complete the Hospital Anxiety and Depression Scale (HADS) so that we can record your level of anxiety. If we are concerned about your anxiety then we will contact your GP with your permission.

The interview will be recorded on a digital recorder and then transcribed by the interviewer. Your name or details will not be used on the transcripts and a code will be allocated to your interview which is only known to the interviewer. Therefore, all

responses will be anonymous. We will send you a copy of the transcript for your reference and to see if you wish to add any further comments.

**What do I have to do?**

If you agree to take part in this research then please let the researcher or the physiotherapist know. The researcher will then contact you to arrange the interview. On the day of the interview the researcher will ask you to sign an informed consent form (a copy is included) before starting the interview.

**What are the possible disadvantages of taking part?**

We do not feel that there are any disadvantages in taking part in this study.

**What are the possible benefits of taking part?**

There are no direct benefits in participating in this study. However, information we get from this study may be used to improve the treatment of people with COPD.

**What if something goes wrong?**

If you are harmed by taking part in this research project there are no special compensation arrangements. If you are harmed due to someone's negligence, then you may have grounds for legal action but you may have to pay for it. The normal National Health Service complaints service will still be available to you. If you are worried about any aspect of this study, you should ask to speak to the researcher or academic supervisor who will do their best to answer your questions (please see contact details at end of sheet). If you are still unhappy and wish to complain formally, you can do this through the NHS Complaints Procedure. Details can be obtained from the hospital.

**Will my taking part in this study be kept confidential?**

All information which is collected about you during the course of the research will be kept strictly confidential. Any information about you which leaves the university or hospital will have your name and address removed so that you cannot be recognised from it. All interview data will be allocated a code and will be kept in a locked room which can only be accessed by people directly involved in the research. The data collected will only be used for this research project. The data will be kept for 5 years and after this time it will be deleted.

**Will my GP be informed?**

Your GP will be told that you are taking part in this research. Also, if we are concerned about your anxiety then we will contact your GP with your permission.

**What will happen if I don't wish to carry on with the study?**

You are free to stop taking part in the study at any time. Any information and interview data collected up to this point will be destroyed and your personal details removed from the study. This will not affect the care that you receive.

**What will happen to the results of the research study?**

The findings of the study will be used by the researcher in order to gain a PhD. It is also hoped that findings from the research will be published in scientific journals. We will let you know of any work which is published as a result of this research. However, you will not be identified in any report or publication.

**Who is organising and funding the research?**

The Manchester Metropolitan University Research Institute of Health, Psychology and Social Care.

**Who has reviewed the study?**

All research in the NHS is looked at by an independent group of people, called a Research Ethics Committee to protect your safety, rights, wellbeing and dignity. This study has been reviewed and given a favourable opinion by Lancaster Research Ethics Committee. This study has also been reviewed and given a favourable opinion by the Manchester Metropolitan University Research Ethics Committee.

**Who do I contact for further information?**

For general information about research, specific information about this research project, or if you are unhappy with the study, please contact:

Thomas Willgoss  
Department of Health Professions  
Manchester Metropolitan University  
Elizabeth Gaskell Campus  
Hathersage Road  
Manchester  
M13 0JA  
Tel: 07951727110  
Email: [Thomas.g.willgoss@stu.mmu.ac.uk](mailto:Thomas.g.willgoss@stu.mmu.ac.uk)

If you wish to make a complaint about this research, please contact the academic supervisor:

Dr Abebaw Yohannes

Department of Health Professions  
Manchester Metropolitan University  
Elizabeth Gaskell Campus  
Hathersage Road  
Manchester  
M13 0JA  
Tel: 0161 247 2943  
Email: [A.Yohannes@mmu.ac.uk](mailto:A.Yohannes@mmu.ac.uk)

For advice as to whether you should participate in this research please contact:

Janet Severn  
Pulmonary Rehabilitation Co-ordinator  
Royal Oldham Hospital  
Oldham  
OL1 2JH  
Email: [Janet.Severn@pat.nhs.uk](mailto:Janet.Severn@pat.nhs.uk)

Or

Paula Baker  
Acute Physiotherapy Site Lead  
Royal Oldham Hospital  
Oldham  
OL1 2JH  
Tel: 0161 656 1377  
Email: [Paula.Baker@pat.nhs.uk](mailto:Paula.Baker@pat.nhs.uk)

You will be given a copy of this information sheet and a signed consent form to keep.

## Appendix 5: Phase 1.2 Informed consent form

The Pennine Acute Hospitals NHS Trust



Centre Number:  
Participant Identification Number for this trial:

### CONSENT FORM Phase 1 Interviews (Version 2.1 02/06/10)

Title of Project: **The development and validation of a novel scale to screen and measure anxiety syndrome in patients with Chronic Obstructive Pulmonary Disease (COPD)**

Name of researcher: **Thomas Willgoss**

Please initial box

1. I confirm that I have read and understand the information sheet dated.....  
for the above study. I have had the opportunity to consider the information, ask  
questions and have had these answered satisfactorily.
2. I understand that my participation is voluntary and that I am free to withdraw at  
any time without giving any reason, without my medical care or legal rights  
being affected.
3. I agree to my interview being recorded, transcribed and used for research  
purposes. I understand that any data is confidential and anonymous. I agree to  
the researcher sending me a copy of the interview transcript for my reference.
4. I agree to my GP being informed of my participation in the study.
5. I agree to take part in the above study.

☐☐☐☐☐

\_\_\_\_\_  
Name of participant

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Name of person  
taking consent

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature

When completed, 1 for patient; 1 for researcher site file; 1 (original) to be kept in medical notes.

## Appendix 6: Hospital Anxiety and Depression Scale (HADS; Zigmund & Snaith, 1983)

This questionnaire will help your physician to know how you are feeling. Read every sentence. Place an "X" on the answer that best describes how you have been feeling during the LAST WEEK. You do not have to think too much to answer. In this questionnaire, spontaneous answers are more important.

<b>1</b> I feel tense or wound up:		<b>8</b> I feel as if I am slowed down:	
Most of the time	<input type="checkbox"/>	Nearly all the time	<input type="checkbox"/>
A lot of the time	<input type="checkbox"/>	Very often	<input type="checkbox"/>
Time to time, occasionally	<input type="checkbox"/>	Sometimes	<input type="checkbox"/>
Not at all	<input type="checkbox"/>	Not at all	<input type="checkbox"/>
<b>2</b> I still enjoy the things I used to enjoy:		<b>9</b> I get a sort of frightened feeling like "butterflies" in the stomach:	
Definitely as much	<input type="checkbox"/>	Not at all	<input type="checkbox"/>
Not quite so much	<input type="checkbox"/>	Occasionally	<input type="checkbox"/>
Only a little	<input type="checkbox"/>	Quite often	<input type="checkbox"/>
Hardly at all	<input type="checkbox"/>	Very often	<input type="checkbox"/>
<b>3</b> I get a sort of frightened feeling as if something awful is about to happen:		<b>10</b> I have lost interest in my appearance:	
Very definitely and quite badly	<input type="checkbox"/>	Definitely	<input type="checkbox"/>
Yes, but not too badly	<input type="checkbox"/>	I don't take so much care as I should	<input type="checkbox"/>
A little, but it doesn't worry me	<input type="checkbox"/>	I may not take quite as much care	<input type="checkbox"/>
Not at all	<input type="checkbox"/>	I take just as much care as ever	<input type="checkbox"/>
<b>4</b> I can laugh and see the funny side of things:		<b>11</b> I feel restless as if I have to be on the move:	
As much as I always could	<input type="checkbox"/>	Very much indeed	<input type="checkbox"/>
Not quite so much now	<input type="checkbox"/>	Quite a lot	<input type="checkbox"/>
Definitely not so much now	<input type="checkbox"/>	Not very much	<input type="checkbox"/>
Not at all	<input type="checkbox"/>	Not at all	<input type="checkbox"/>
<b>5</b> Worrying thoughts go through my mind:		<b>12</b> I look forward with enjoyment to things:	
A great deal of the time	<input type="checkbox"/>	As much as I ever did	<input type="checkbox"/>
A lot of the time	<input type="checkbox"/>	Rather less than I used to	<input type="checkbox"/>
From time to time but not too often	<input type="checkbox"/>	Definitely less than I used to	<input type="checkbox"/>
Only occasionally	<input type="checkbox"/>	Hardly at all	<input type="checkbox"/>
<b>6</b> I feel cheerful		<b>13</b> I get sudden feelings of panic:	
Not at all	<input type="checkbox"/>	Very often indeed	<input type="checkbox"/>
Not often	<input type="checkbox"/>	Quite often	<input type="checkbox"/>
Sometimes	<input type="checkbox"/>	Not very often	<input type="checkbox"/>
Most of the time	<input type="checkbox"/>	Not at all	<input type="checkbox"/>
<b>7</b> I can sit at ease and feel relaxed:		<b>14</b> I can enjoy a good book or radio or TV programme:	
Definitely	<input type="checkbox"/>	Often	<input type="checkbox"/>
Usually	<input type="checkbox"/>	Sometimes	<input type="checkbox"/>
Not often	<input type="checkbox"/>	Not often	<input type="checkbox"/>
Not at all	<input type="checkbox"/>	Very seldom	<input type="checkbox"/>

## Appendix 7: Draft 16-item Anxiety Inventory for Respiratory disease (AIR)



Anxiety Inventory for  
Respiratory disease

Name / Code:

Date:

### Anxiety Inventory for Respiratory disease (AIR) (Version 4.0)

Please think back over the **past 2 weeks** and mark (X) in the box that best describes how you have felt. Be sure to only select one response for each item.

I have felt tense, restless or wound-up			
Not at all	Occasionally	Frequently	Almost all of the time

I have felt irritable and/or easily annoyed			
Not at all	Occasionally	Frequently	Almost all of the time

I have found it difficult to concentrate on things, such as watching TV or reading			
Not at all	Occasionally	Frequently	Almost all of the time

I have had worrying thoughts going through my mind			
Not at all	Occasionally	Frequently	Almost all of the time



I have felt very frightened or panicky			
Not at all	Occasionally	Frequently	Almost all of the time

I have felt worked-up and/or upset			
Not at all	Occasionally	Frequently	Almost all of the time

I have had a fear of losing control and/or falling apart			
Not at all	Occasionally	Frequently	Almost all of the time

I have worried about experiencing panic			
Not at all	Occasionally	Frequently	Almost all of the time

I have found it hard to relax			
Not at all	Occasionally	Frequently	Almost all of the time

I have had sudden and intense feelings of fear and/or panic			
Not at all	Occasionally	Frequently	Almost all of the time

I have felt generally anxious			
Not at all	Occasionally	Frequently	Almost all of the time

I have had thoughts that something bad might happen			
Not at all	Occasionally	Frequently	Almost all of the time

I have felt nervous or on-edge			
Not at all	Occasionally	Frequently	Almost all of the time

I have avoided situations that I felt might lead me to panic			
Not at all	Occasionally	Frequently	Almost all of the time

I have worried about doing everyday tasks, such as going shopping or visiting a friend			
Not at all	Occasionally	Frequently	Almost all of the time

I have felt relaxed and in control			
Not at all	Occasionally	Frequently	Almost all of the time

## Appendix 8: Phase 2 Participant Information Sheet

Tameside Hospital   
NHS Foundation Trust

The Pennine Acute Hospitals   
NHS Trust

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Department of Health Professions  
Manchester Metropolitan University  
Elizabeth Gaskell Campus  
Hathersage Road  
Manchester  
M13 0JA

Date:

### **PARTICIPANT INFORMATION SHEET- Phase 2 Item analysis (Version 2.1, 02/06/10)**

**Title of project: The development and validation of a novel scale to screen and measure anxiety syndrome in patients with Chronic Obstructive Pulmonary Disease (COPD)**

You are being invited to take part in a research study which is being undertaken as part of the researcher's PhD. Before you decide if you wish to take part it is important for you to understand why the research is being done and what it will involve. Please read this information carefully and talk it through with someone else if you wish. Also, please ask us if there is anything that is not clear or if you would like more information.

Thank you for reading this.

### **What is the purpose of the study?**

Previous research has found that patients with COPD often suffer with anxiety which can lead to a poorer quality of life and an increased hospital visits. However, we do not know how common this problem is. One of the problems with detecting anxiety in patients with COPD is that at the moment, there is no specific tool to

identify anxiety. Existing scales are designed for the general public and therefore do not take into account how people with COPD experience anxiety. Research has found that many of the symptoms of anxiety overlap with symptoms of COPD, making it difficult to tell the difference between the two. We are planning to design a new scale to detect anxiety specifically in patients with COPD. This scale will be easy to complete and may help medical professionals identify people who may need further help.

This research has three objectives:

1. To investigate how people with COPD experience anxiety.
2. To design a new anxiety scale which is simple to complete.
3. To test if the new scale is reliable and valid.

### **Why have I been chosen?**

We are hoping to recruit 200 patients in Greater Manchester with COPD who can help us to develop a new scale to measure symptoms of anxiety.

### **Do I have to take part?**

No, taking part is voluntary. This is a research study and it is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you take part you are still free to stop at any time without giving reason. This will not affect the standard of care you receive.

### **What will happen to me if I take part?**

You will be asked to fill out a questionnaire (taking about 2-3 minutes) during your visit. The questionnaire will ask you about any anxiety symptoms that you may have had in recent weeks.

### **What do I have to do?**

The researcher will contact you and answer any questions you might have. You can then decide whether or not you would like to take part in this research. If you do decide to take part then we will ask you to sign an informed consent form (a copy is included) before giving you the questionnaire.

### **What are the possible disadvantages of taking part?**

We do not feel that there are any disadvantages in taking part in this study.

### **What are the possible benefits of taking part?**

There are no direct benefits in participating in this study. However, information we get from this study may be used to improve the treatment of people with COPD.

**What if something goes wrong?**

If you are harmed by taking part in this research project there are no special compensation arrangements. If you are harmed due to someone's negligence, then you may have grounds for legal action but you may have to pay for it. The normal National Health Service complaints service will still be available to you. If you are worried about any aspect of this study, you should ask to speak to the researcher or academic supervisor who will do their best to answer your questions (please see contact details at end of sheet). If you are still unhappy and wish to complain formally, you can do this through the NHS Complaints Procedure. Details are available from the hospital.

**Will my taking part in this study be kept confidential?**

All information which is collected about you during the course of the research will be kept strictly confidential. Any information about you which leaves the university or hospital will have your name and address removed so that you cannot be recognised from it. To ensure anonymity, all information you provide will be allocated a code. All data will be kept in a locked room which can only be accessed by people directly involved in the research. The data collected will only be used for this research project. The data will be kept for 5 years and after this time it will be deleted.

**Will my GP be informed?**

Your GP will be told that you are taking part in this research. Also, if we are concerned about your anxiety then we will contact your GP with your permission.

**What will happen if I don't wish to carry on with the study?**

You are free to stop taking part in the study at any time. Any information collected up to this point will be destroyed and your personal details removed from the study. This will not affect the care that you receive.

**What will happen to the results of the research study?**

The findings of the study will be used by the researcher in order to gain a PhD. It is also hoped that findings from the research will be published in scientific journals. We will let you know of any work which is published as a result of this research. However, you will not be identified in any report or publication.

**Who is organising and funding the research?**

The Manchester Metropolitan University Research Institute of Health, Psychology and Social Care.

**Who has reviewed the study?**

All research in the NHS is looked at by an independent group of people, called a Research Ethics Committee to protect your safety, rights, wellbeing and dignity. This study has been reviewed and given a favourable opinion by Lancaster Research Ethics Committee. This study has also been reviewed and given a favourable opinion by the Manchester Metropolitan University Research Ethics Committee.

**Who do I contact for further information?**

For general information about research, specific information about this research project, or if you are unhappy with the study, please contact:

Thomas Willgoss  
Department of Health Professions  
Manchester Metropolitan University  
Elizabeth Gaskell Campus  
Hathersage Road  
Manchester  
M13 0JA  
Tel: 07951727110  
Email: [Thomas.g.willgoss@stu.mmu.ac.uk](mailto:Thomas.g.willgoss@stu.mmu.ac.uk)

If you wish to make a complaint about this research, please contact the academic supervisor:

Dr Abebaw Yohannes  
Department of Health Professions  
Manchester Metropolitan University  
Elizabeth Gaskell Campus  
Hathersage Road  
Manchester  
M13 0JA  
Tel: 0161 247 2943  
Email: [A.Yohannes@mmu.ac.uk](mailto:A.Yohannes@mmu.ac.uk)

## Appendix 9: Phase 2 Informed Consent Form



Manchester  
Metropolitan  
University



British Lung Foundation

Centre Number:

Patient Identification Number for this study:

### CONSENT FORM Phase 2 Item analysis (Version 2.1 02/06/10)

Title of Project: **The development and validation of a novel scale to screen and measure anxiety syndrome in patients with Chronic Obstructive Pulmonary Disease (COPD)**

Name of researcher: **Thomas Willgoss**

Please initial box

1. I confirm that I understand the purpose of this study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected.
3. I agree to my GP being informed of my participation in the study.
4. I agree to take part in the above study.

☐☐☐☐

\_\_\_\_\_  
Name of participant

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Name of person  
taking consent

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature

## Appendix 10: Anxiety Inventory for Respiratory disease (AIR)



Anxiety Inventory for  
Respiratory disease

Name / Code:

Date:

Please think back over the past 2 weeks and mark or circle the response that best describes how you have felt. Be sure to only select one response for each item.

SCORE

Please leave  
blank

<b>I have had worrying thoughts going through my mind</b>				
Not at all	Occasionally	Frequently	Almost all of the time	
<b>I have felt very frightened or panicky</b>				
Not at all	Occasionally	Frequently	Almost all of the time	
<b>I have felt worked-up and/or upset</b>				
Not at all	Occasionally	Frequently	Almost all of the time	
<b>I have had a fear of losing control and/or falling apart</b>				
Not at all	Occasionally	Frequently	Almost all of the time	
<b>I have worried about experiencing panic</b>				
Not at all	Occasionally	Frequently	Almost all of the time	
<b>I have found it hard to relax</b>				
Not at all	Occasionally	Frequently	Almost all of the time	
<b>I have had sudden and intense feelings of fear and/or panic</b>				
Not at all	Occasionally	Frequently	Almost all of the time	
<b>I have felt generally anxious</b>				
Not at all	Occasionally	Frequently	Almost all of the time	
<b>I have felt nervous or on-edge</b>				
Not at all	Occasionally	Frequently	Almost all of the time	
<b>I have had thoughts that something bad might happen</b>				
Not at all	Occasionally	Frequently	Almost all of the time	
<b>TOTAL SCORE</b>				



## Appendix 11: Phase 2 Patient feedback form

### AIR (Anxiety Inventory for Respiratory disease) Feedback

- 1) Please rate with a score of 0-10 how easy the scale was to complete.

0= not easy at all

10= extremely easy

- 2) Please rate with a score of 0-10 how helpful you feel the scale is in reflecting your experiences of anxiety.

0= not helpful at all

10= extremely helpful

- 3) Please rate with a score of 0-10 how easy the scale was to understand.

0= not easy at all

10= extremely easy

Please use the space below to add any additional comments you might have about the scale and your experience of completing it.

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Thank you for your feedback.

## Appendix 12: Phase 3 Participant Information Sheet

Tameside Hospital   
NHS Foundation Trust

The Pennine Acute Hospitals   
NHS Trust



Department of Health Professions  
Manchester Metropolitan University  
Elizabeth Gaskell Campus  
Hathersage Road  
Manchester  
M13 0JA

Date:

### **PARTICIPANT INFORMATION SHEET- Phase 3 Scale validation (Version 3.2, 17/03/11)**

**Title of project: The development and validation of a novel scale to screen and measure anxiety syndrome in patients with Chronic Obstructive Pulmonary Disease (COPD)**

You are being invited to take part in a research study which is being undertaken as part of the researcher's PhD. Before you decide if you wish to take part, it is important for you to understand why the research is being done and what it will involve. Please read this following information carefully and talk it through with someone else if you wish. Also, please ask us if there is anything that is not clear or if you would like more information.

Thank you for reading this.

#### **What is the purpose of the study?**

Previous research has found that patients with COPD often suffer with anxiety which can lead to a poorer quality of life and an increased hospital visits. However, we do not know how common this problem is. One of the problems with detecting anxiety in patients with COPD is that at the moment, there is no specific tool to identify anxiety. Existing scales are designed for the general public and therefore do

not take into account how people with COPD experience anxiety. Research has found that many of the symptoms of anxiety overlap with symptoms of COPD, making it difficult to tell the difference between the two. We are planning to design a new scale to detect anxiety, specifically in patients with COPD. This scale will be easy to complete and may help medical professionals identify people who may need further help.

This research has three objectives:

1. To investigate how people with COPD experience anxiety.
2. To design a new anxiety scale which is simple to complete.
3. To test if the new scale is reliable and valid.

### **Why have I been chosen?**

We are hoping to recruit 100 patients in Greater Manchester with COPD who can help us to test the validity and reliability of a new scale to measure symptoms of anxiety.

### **Do I have to take part?**

No, taking part is voluntary. This is a research study and it is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you take part you are still free to stop at any time without giving reason. This will not affect the standard of care you receive.

### **What will happen to me if I take part?**

You will be asked to complete four short questionnaires (taking about 10 minutes). The questionnaires will ask about your quality of life, day-to-day activities and about any feelings of anxiety that you may have had in recent weeks. The interviewer will also ask you a few questions about you and your lifestyle (age, if you are a smoker etc). After 2 weeks we will send you a copy of the questionnaires for you to complete again. If there has been a change in your health during this time then you do not need to complete the questionnaires.

In addition, we will be selecting a number of participants at random to undergo a short clinical interview (taking about 20 minutes) during which a clinician will ask you more detailed questions about any symptoms of anxiety that you may have experienced. Participation in this part of the research is **completely optional** and you are free to withdraw at any time without giving reason.

**What do I have to do?**

The researcher will contact you and answer any questions you might have. You can then decide whether or not you would like to take part in this research. If you do decide to take part then we will ask you to sign an informed consent form (a copy is included) before giving you the questionnaires.

**What are the possible disadvantages of taking part?**

We do not feel that there are any disadvantages in taking part in this study.

**What are the possible benefits of taking part?**

There are no direct benefits in participating in this study. However, information we get from this study may be used to improve the treatment of people with COPD.

**What if something goes wrong?**

If you are harmed by taking part in this research project there are no special compensation arrangements. If you are harmed due to someone's negligence, then you may have grounds for legal action but you may have to pay for it. The normal National Health Service complaints service will still be available to you. If you are worried about any aspect of this study, you should ask to speak to the researcher or academic supervisor who will do their best to answer your questions (please see contact details at end of sheet). If you are still unhappy and wish to complain formally, you can do this through the NHS Complaints Procedure. Details are available from the hospital.

**Will my taking part in this study be kept confidential?**

All information which is collected about you during the course of the research will be kept strictly confidential. Any information about you which leaves the university or hospital will have your name and address removed so that you cannot be recognised from it. To ensure anonymity, all information you provide will be allocated a code. All data will be kept in a locked room which can only be accessed by people directly involved in the research. The data collected will only be used for this research project. The data will be kept for 5 years and after this time it will be deleted.

**Will my GP be informed?**

Your GP will be told that you are taking part in this research. Also, if we are concerned about your anxiety then we will contact your GP with your permission.

**What will happen if I don't wish to carry on with the study?**

You are free to stop taking part in the study at any time. Any information collected up to this point will be destroyed and your personal details removed from the study. This will not affect the care that you receive.

### **What will happen to the results of the research study?**

The findings of the study will be used by the researcher in order to gain a PhD. It is also hoped that findings from the research will be published in scientific journals. We will let you know of any work which is published as a result of this research. However, you will not be identified in any report or publication.

### **Who is organising and funding the research?**

The Manchester Metropolitan University Research Institute of Health, Psychology and Social Care.

### **Who has reviewed the study?**

All research in the NHS is looked at by an independent group of people, called a Research Ethics Committee to protect your safety, rights, wellbeing and dignity. This study has been reviewed and given a favourable opinion by Lancaster Research Ethics Committee. This study has also been reviewed and given a favourable opinion by the Manchester Metropolitan University Research Ethics Committee.

### **Who do I contact for further information?**

For general information about research, specific information about this research project, or if you are unhappy with the study, please contact:

Thomas Willgoss  
Department of Health Professions  
Manchester Metropolitan University  
Elizabeth Gaskell Campus  
Hathersage Road  
Manchester  
M13 0JA  
Tel: 07951727110  
Email: [Thomas.g.willgoss@stu.mmu.ac.uk](mailto:Thomas.g.willgoss@stu.mmu.ac.uk)

If you wish to make a complaint about this research, please contact the academic supervisor:

Dr Abebaw Yohannes  
Department of Health Professions  
Manchester Metropolitan University  
Elizabeth Gaskell Campus  
Hathersage Road

Manchester  
M13 0JA  
Tel: 0161 247 2943  
Email: [A.Yohannes@mmu.ac.uk](mailto:A.Yohannes@mmu.ac.uk)

For advice as to whether you should participate in this research please contact:

Catharine Thomas  
Consultant Physiotherapist  
Tameside Hospital NHS Foundation Trust  
Fountain Street  
Ashton-under-Lyne  
OL6 9RW  
Tel: 0161 922 4123  
Email: [Catharine.Thomas@tgh.nhs.uk](mailto:Catharine.Thomas@tgh.nhs.uk)

You will be given a copy of this information sheet and a signed consent form to keep.

## Appendix 13: Phase 3 Informed Consent Form



Centre Number:

Patient Identification Number for this trial:

### CONSENT FORM Phase 3 Scale validation (Version 3.2 17/03/11)

Title of Project: **The development and validation of a novel scale to screen and measure anxiety syndrome in patients with Chronic Obstructive Pulmonary Disease (COPD)**

Name of researcher: **Thomas Willgoss**

Please initial box

6. I confirm that I have read and understand the information sheet dated.....  
for the above study. I have had the opportunity to consider the information, ask  
questions and have had these answered satisfactorily.
7. I understand that my participation is voluntary and that I am free to withdraw at  
any time without giving any reason, without my medical care or legal rights  
being affected.
8. I agree to my GP being informed of my participation in the study.
9. I agree to participate in a clinical interview if selected (optional).
10. I agree to take part in the above study.

☐☐☐☐☐

\_\_\_\_\_  
Name of participant

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Name of person  
taking consent

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature

When completed, 1 for patient; 1 for researcher site file; 1 (original) to be kept in medical notes.

## Appendix 14: Phase 3 Invitation letter

The Pennine Acute Hospitals   
NHS Trust

Tameside Hospital   
NHS Foundation Trust



Acute Respiratory Support Service  
(COPD support team)



### Invitation to participate in a research project

**Would you like to be involved in a short research project that might help improve the treatment of COPD in the future?**

We are inviting people with COPD to complete several brief questionnaires. The questionnaires have been designed to explore how COPD affects everyday life and to help us understand the relationships between COPD and anxiety.

The questionnaires will take approximately 10 minutes to complete.

Before you decide whether you wish to take part, please read the enclosed information sheet.

If you are interested in participating, please complete the slip below and return in the pre-paid envelope. Alternatively, you can contact the researcher directly on:

Telephone: 07951727110

or

0161 247 2610

Email: [Thomas.g.willgoss@stu.mmu.ac.uk](mailto:Thomas.g.willgoss@stu.mmu.ac.uk)

Thank you for your cooperation.

✂-----

Please fill in your details and return in the pre-paid envelope to Thomas Willgoss, Manchester Metropolitan University, Department of Health Professions, Elizabeth Gaskell Campus, Hathersage Road, Manchester, M13 0JA.



**Name** \_\_\_\_\_ **Gender** \_\_\_\_\_

**D.O.B.** \_\_\_\_\_

**Adress** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Telephone**  
**number** \_\_\_\_\_

**Email** \_\_\_\_\_

## Appendix 15: Phase 3 follow-up letter



Manchester  
Metropolitan  
University

The Pennine Acute Hospitals   
NHS Trust

Tameside Hospital   
NHS Foundation Trust

Dear [Name],

### Re. Anxiety questionnaire for COPD research project

Thank you for participating in this research project on [Date]. Your help in filling out the questionnaires is much appreciated.

As discussed during my visit, I am sending out the same questionnaires to be completed a second time. This will allow us to test how reliable the questionnaires are over time. Therefore, please could you complete the enclosed questionnaires and return them in the pre-paid envelope.

In addition, it is important for us to know if there has been any major change in your health status (e.g., an exacerbation of COPD), so please tick one of the boxes below:

There has not been a major change in my health status since [Date]

☐

There has been a major change in my health status since [Date]

☐

Once you have completed the questionnaires, please return them along with this letter in the envelope provided.

If you have any questions regarding this research or the completion of the questionnaires then please do not hesitate to contact me:

Telephone: 0161 247 2610 or 07951727110

Email: [Thomas.g.willgoss@stu.mmu.ac.uk](mailto:Thomas.g.willgoss@stu.mmu.ac.uk)

Thank you for your time and participation.

Yours sincerely,

Thomas Willgoss (Principal Investigator)

## Appendix 16: COPD Assessment Tool (CAT; Jones et al., 2009)

Your name:

Today's date:

  
COPD Assessment Test

### How is your COPD? Take the COPD Assessment Test™ (CAT)

This questionnaire will help you and your healthcare professional measure the impact COPD (Chronic Obstructive Pulmonary Disease) is having on your wellbeing and daily life. Your answers, and test score, can be used by you and your healthcare professional to help improve the management of your COPD and get the greatest benefit from treatment.

For each item below, place a mark (X) in the box that best describes you currently. Be sure to only select one response for each question.

**Example:** I am very happy    0 ☒ 1 2 3 4 5    I am very sad

		SCORE
I never cough	0 1 2 3 4 5	I cough all the time
I have no phlegm (mucus) in my chest at all	0 1 2 3 4 5	My chest is completely full of phlegm (mucus)
My chest does not feel tight at all	0 1 2 3 4 5	My chest feels very tight
When I walk up a hill or one flight of stairs I am not breathless	0 1 2 3 4 5	When I walk up a hill or one flight of stairs I am very breathless
I am not limited doing any activities at home	0 1 2 3 4 5	I am very limited doing activities at home
I am confident leaving my home despite my lung condition	0 1 2 3 4 5	I am not at all confident leaving my home because of my lung condition
I sleep soundly	0 1 2 3 4 5	I don't sleep soundly because of my lung condition
I have lots of energy	0 1 2 3 4 5	I have no energy at all
		<b>TOTAL SCORE</b>

COPD Assessment Test and CAT logo is a trademark of the GlaxoSmithKline group of companies.  
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## Appendix 17: Manchester Respiratory Activities of Daily Living questionnaire (MRADL; Yohannes et al., 2000b)

### The Manchester Respiratory Activities of Daily Living Questionnaire

This questionnaire is designed to give us a better idea of how your breathing problems are affecting you in your daily life.

Please read each question carefully and tick the lines which best describe you.

	Not at all	With help	Alone with difficulty	Alone easily
<b>MOBILITY</b>				
Do you:				
Walk around outside?	-----	-----	-----	-----
Climb stairs?	-----	-----	-----	-----
Get in and out of the car?	-----	-----	-----	-----
Walk over uneven ground?	-----	-----	-----	-----
Cross roads?	-----	-----	-----	-----
Travel on public transport?	-----	-----	-----	-----
Bend over from standing?	-----	-----	-----	-----
<b>IN THE KITCHEN</b>				
Do you:				
Lift something off a shelf which is above your shoulder height?	-----	-----	-----	-----
Take hot drinks from one room to another?	-----	-----	-----	-----
Do the washing up?	-----	-----	-----	-----
Make yourself a hot snack?	-----	-----	-----	-----
<b>DOMESTIC TASKS</b>				
Do you:				
Do general housework?	-----	-----	-----	-----
Wash small items of clothing?	-----	-----	-----	-----
Do your own shopping?	-----	-----	-----	-----
Do a full clothes wash?	-----	-----	-----	-----
Wash and dry yourself?	-----	-----	-----	-----
Have a bath?	-----	-----	-----	-----
<b>LEISURE ACTIVITIES</b>				
Do you:				
Go out socially?	-----	-----	-----	-----
Manage your own garden?	-----	-----	-----	-----
Do you have to eat more slowly than you would like? (*)	Much more slowly -----	Quite a lot more slowly -----	A little more slowly -----	Not at all more slowly -----
Does your breathing keep you awake at night? (*)	Most of the night -----	For 1–2 hours -----	For up to $\frac{1}{2}$ hour -----	Not at all -----

## Appendix 18: Patient Health Questionnaire anxiety and panic screening sections (Spitzer et al., 1999)

### 1. Questions about anxiety.

	NO	YES
a. In the last 4 weeks, have you had an anxiety attack — suddenly feeling fear or panic?	<input type="checkbox"/>	<input type="checkbox"/>
<b>If you checked "NO", go to question #3</b>		
b. Has this ever happened before?	<input type="checkbox"/>	<input type="checkbox"/>
c. Do some of these attacks come suddenly out of the blue — that is, in situations where you don't expect to be nervous or uncomfortable?	<input type="checkbox"/>	<input type="checkbox"/>
d. Do these attacks bother you a lot or are you worried about having another attack?	<input type="checkbox"/>	<input type="checkbox"/>

### 2. Think about your last bad anxiety attack.

	NO	YES
a. Were you short of breath?	<input type="checkbox"/>	<input type="checkbox"/>
b. Did your heart race, pound, or skip?	<input type="checkbox"/>	<input type="checkbox"/>
c. Did you have chest pain or pressure?	<input type="checkbox"/>	<input type="checkbox"/>
d. Did you sweat?	<input type="checkbox"/>	<input type="checkbox"/>
e. Did you feel as if you were choking?	<input type="checkbox"/>	<input type="checkbox"/>
f. Did you have hot flashes or chills?	<input type="checkbox"/>	<input type="checkbox"/>
g. Did you have nausea or an upset stomach, or the feeling that you were going to have diarrhea?	<input type="checkbox"/>	<input type="checkbox"/>
h. Did you feel dizzy, unsteady, or faint?	<input type="checkbox"/>	<input type="checkbox"/>
i. Did you have tingling or numbness in parts of your body?...	<input type="checkbox"/>	<input type="checkbox"/>
j. Did you tremble or shake?	<input type="checkbox"/>	<input type="checkbox"/>
k. Were you afraid you were dying?	<input type="checkbox"/>	<input type="checkbox"/>

### 3. Over the last 4 weeks, how often have you been bothered by any of the following problems?

	Not at all	Several days	More than half the days
a. Feeling nervous, anxious, on edge, or worrying a lot about different things.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>If you checked "Not at all", this is the end of the questionnaire</b>			
b. Feeling restless so that it is hard to sit still.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Getting tired very easily.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Muscle tension, aches, or soreness.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Trouble falling asleep or staying asleep.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. Trouble concentrating on things, such as reading a book or watching TV.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## **Appendix 19: MINI Sections A, E-I and O (major depressive and anxiety disorders)**

# **M.I.N.I.**

## **MINI INTERNATIONAL NEUROPSYCHIATRIC INTERVIEW**

English Version 5.0.0

DSM-IV

USA: D. Sheehan, J. Janavs, R. Baker, K. Harnett-Sheehan, E. Knapp, M. Sheehan  
University of South Florida - Tampa

FRANCE: Y. Lecrubier, E. Weiller, T. Hergueta, P. Amorim, L. I. Bonora, J. P. Lépine  
Hôpital de la Salpêtrière - Paris

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### **DISCLAIMER**

Our aim is to assist in the assessment and tracking of patients with greater efficiency and accuracy. Before action is taken on any data collected and processed by this program, it should be reviewed and interpreted by a licensed clinician.

This program is not designed or intended to be used in the place of a full medical and psychiatric evaluation by a qualified licensed physician – psychiatrist. It is intended only as a tool to facilitate accurate data collection and processing of symptoms elicited by trained personnel.

M.I.N.I. 5.0.0 (July 1, 2006)

<b>Patient Name:</b>		<b>Patient Number:</b>	
<b>Date of Birth:</b>		<b>Time Interview Began:</b>	
<b>Interviewer's Name:</b>		<b>Time Interview Ended:</b>	
<b>Date of Interview:</b>		<b>Total Time:</b>	

MODULES	TIME FRAME	MEETS CRITERIA	DSM-IV	ICD-10	
A MAJOR DEPRESSIVE EPISODE	Current (2 weeks)	<input type="checkbox"/>	296.20-296.26 Single	F32.x	<input type="checkbox"/>
	Recurrent	<input type="checkbox"/>	296.30-296.36 Recurrent	F33.x	<input type="checkbox"/>
MDE WITH MELANCHOLIC FEATURES Optional	Current (2 weeks)	<input type="checkbox"/>	296.20-296.26 Single	F32.x	<input type="checkbox"/>
			296.30-296.36 Recurrent	F33.x	<input type="checkbox"/>
B DYSTHYMIA	Current (Past 2 years)	<input type="checkbox"/>	300.4	F34.1	<input type="checkbox"/>
C SUICIDALITY	Current (Past Month) Risk: <input type="checkbox"/> Low <input type="checkbox"/> Medium <input type="checkbox"/> High	<input type="checkbox"/>			<input type="checkbox"/>
D MANIC EPISODE	Current	<input type="checkbox"/>	296.00-296.06	F30.x-F31.9	<input type="checkbox"/>
HYPOMANIC EPISODE	Past	<input type="checkbox"/>			
	Current	<input type="checkbox"/>	296.80-296.89	F31.8-F31.9/F34.0	<input type="checkbox"/>
	Past	<input type="checkbox"/>			
E PANIC DISORDER	Current (Past Month) Lifetime	<input type="checkbox"/> <input type="checkbox"/>	300.01/300.21	F40.01-F41.0	<input type="checkbox"/>
F AGORAPHOBIA	Current	<input type="checkbox"/>	300.22	F40.00	<input type="checkbox"/>
G SOCIAL PHOBIA (Social Anxiety Disorder)	Current (Past Month)	<input type="checkbox"/>	300.23	F40.1	<input type="checkbox"/>
H OBSESSIVE-COMPULSIVE DISORDER	Current (Past Month)	<input type="checkbox"/>	300.3	F42.8	<input type="checkbox"/>
I POSTTRAUMATIC STRESS DISORDER	Current (Past Month)	<input type="checkbox"/>	309.81	F43.1	<input type="checkbox"/>
J ALCOHOL DEPENDENCE	Past 12 Months	<input type="checkbox"/>	303.9	F10.2x	<input type="checkbox"/>
ALCOHOL ABUSE	Past 12 Months	<input type="checkbox"/>	305.00	F10.1	<input type="checkbox"/>
K SUBSTANCE DEPENDENCE (Non-alcohol)	Past 12 Months	<input type="checkbox"/>	304.00-90/305.20-90	F11.1-F19.1	<input type="checkbox"/>
SUBSTANCE ABUSE (Non-alcohol)	Past 12 Months	<input type="checkbox"/>	304.00-90/305.20-90	F11.1-F19.1	<input type="checkbox"/>
L PSYCHOTIC DISORDERS	Lifetime	<input type="checkbox"/>	295.10-295.90/297.1/ 297.3/293.81/293.82/ 293.89/298.8/298.9	F20.xx-F29	<input type="checkbox"/>
	Current	<input type="checkbox"/>			
MOOD DISORDER WITH PSYCHOTIC FEATURES	Lifetime	<input type="checkbox"/>	296.24/296.34/296.44	F32.3/F33.3/	<input type="checkbox"/>
	Current	<input type="checkbox"/>	296.24/296.34/296.44	F30.2/F31.2/F31.5 F31.8/F31.9/F39	<input type="checkbox"/>
M ANOREXIA NERVOSA	Current (Past 3 Months)	<input type="checkbox"/>	307.1	F50.0	<input type="checkbox"/>
N BULIMIA NERVOSA	Current (Past 3 Months)	<input type="checkbox"/>	307.51	F50.2	<input type="checkbox"/>
ANOREXIA NERVOSA, BINGE EATING/PURGING TYPE	Current	<input type="checkbox"/>	307.1	F50.0	<input type="checkbox"/>



O	GENERALIZED ANXIETY DISORDER	Current (Past 6 Months)	<input type="checkbox"/>	300.02	F41.1	<input type="checkbox"/>
P	ANTISOCIAL PERSONALITY DISORDER Optional	Lifetime	<input type="checkbox"/>	301.7	F60.2	<input type="checkbox"/>

Which problem troubles you the most? Indicate your response by checking the appropriate check box(es). \_\_\_\_\_

---

## GENERAL INSTRUCTIONS

The MINI was designed as a brief structured interview for the major Axis I psychiatric disorders in DSM-IV and ICD-10. Validation and reliability studies have been done comparing the MINI to the SCID-P for DSM-III-R and the CIDI (a structured interview developed by the World Health Organization for lay interviewers for ICD-10). The results of these studies show that the MINI has acceptably high validation and reliability scores, but can be administered in a much shorter period of time (mean 18.7 ± 11.6 minutes, median 15 minutes) than the above referenced instruments. It can be used by clinicians, after a brief training session. Lay interviewers require more extensive training.

### INTERVIEW:

In order to keep the interview as brief as possible, inform the patient that you will conduct a clinical interview that is more structured than usual, with very precise questions about psychological problems which require a yes or no answer.

### GENERAL FORMAT:

The MINI is divided into modules identified by letters, each corresponding to a diagnostic category.

•At the beginning of each diagnostic module (except for psychotic disorders module), screening question(s) corresponding to the main criteria of the disorder are presented in a gray box.

•At the end of each module, diagnostic box(es) permit the clinician to indicate whether diagnostic criteria are met.

### CONVENTIONS:

*Sentences written in « normal font »* should be read exactly as written to the patient in order to standardize the assessment of diagnostic criteria.

*Sentences written in « CAPITALS »* should not be read to the patient. They are instructions for the interviewer to assist in the scoring of the diagnostic algorithms.

*Sentences written in « bold »* indicate the time frame being investigated. The interviewer should read them as often as necessary. Only symptoms occurring during the time frame indicated should be considered in scoring the responses.

*Answers with an arrow above them (➡)* indicate that one of the criteria necessary for the diagnosis(es) is not met. In this case, the interviewer should go to the end of the module, circle « NO » in all the diagnostic boxes and move to the next module.

When terms are separated by a slash (/) the interviewer should read only those symptoms known to be present in the patient (for example, question H6).

*Phrases in (parentheses)* are clinical examples of the symptom. These may be read to the patient to clarify the question.

### RATING INSTRUCTIONS:

All questions must be rated. The rating is done at the right of each question by circling either Yes or No. Clinical judgment by the rater should be used in coding the responses. The rater should ask for examples when necessary, to ensure accurate coding. The patient should be encouraged to ask for clarification on any question that is not absolutely clear.

The clinician should be sure that each dimension of the question is taken into account by the patient (for example, time frame, frequency, severity, and/or alternatives).

Symptoms better accounted for by an organic cause or by the use of alcohol or drugs should not be coded positive in the MINI. The MINI Plus has questions that investigate these issues.

For any questions, suggestions, need for a training session, or information about updates of the MINI, please contact :

David V Sheehan, M.D., M.B.A.  
University of South Florida College of Medicine  
3515 East Fletcher Avenue  
Tampa, FL USA 33613-4788  
tel : +1 813 974 4544; fax : +1 813 974 4575  
e-mail : dsheehan@hsc.usf.edu

Yves Lecrubier, M.D. / Thierry Hergueta, M.S.  
INSERM U302  
Hôpital de la Salpêtrière  
47, boulevard de l'Hôpital  
F. 75651 PARIS, FRANCE  
tel : +33 (0) 1 42 16 16 59; fax : +33 (0) 1 45 85 28 00  
e-mail : hergueta@ext.jussieu.fr

## A. MAJOR DEPRESSIVE EPISODE

(➡ MEANS : GO TO THE DIAGNOSTIC BOXES, CIRCLE NO IN ALL DIAGNOSTIC BOXES, AND MOVE TO THE NEXT MODULE)

A1	Have you been consistently depressed or down, most of the day, nearly every day, for the past two weeks?	NO	YES
A2	In the past two weeks, have you been much less interested in most things or much less able to enjoy the things you used to enjoy most of the time?	NO	YES
	IS A1 OR A2 CODED YES?	➡ NO	YES

A3 Over the past two weeks, when you felt depressed or uninterested:

- |   |  |    |       |
|---|--|----|-------|
| a | Was your appetite decreased or increased nearly every day? Did your weight decrease or increase without trying intentionally (i.e., by $\pm 5\%$ of body weight or $\pm 8$ lbs. or $\pm 3.5$ kgs., for a 160 lb./70 kg. person in a month)?<br>IF YES TO EITHER, CODE YES. | NO | YES * |
| b | Did you have trouble sleeping nearly every night (difficulty falling asleep, waking up in the middle of the night, early morning awakening or sleeping excessively)?   | NO | YES   |
| c | Did you talk or move more slowly than normal or were you fidgety, restless or having trouble sitting still almost every day?   | NO | YES * |
| d | Did you feel tired or without energy almost every day?   | NO | YES   |
| e | Did you feel worthless or guilty almost every day?   | NO | YES   |
| f | Did you have difficulty concentrating or making decisions almost every day?  | NO | YES   |
| g | Did you repeatedly consider hurting yourself, feel suicidal, or wish that you were dead?   | NO | YES   |

ARE 5 OR MORE ANSWERS (A1-A3) CODED YES?

NO	YES *
<b>MAJOR DEPRESSIVE EPISODE, CURRENT</b>	

IF PATIENT HAS CURRENT MAJOR DEPRESSIVE EPISODE CONTINUE TO A4,  
OTHERWISE MOVE TO MODULE B:

- |    |   |      |     |
|----|---|------|-----|
| A4 | a During your lifetime, did you have other episodes of two weeks or more when you felt depressed or uninterested in most things, and had most of the problems we just talked about? | ➡ NO | YES |
|----|---|------|-----|

- |   |   |
|---|---|
| b | In between 2 episodes of depression, did you ever have an interval of at least 2 months, without any depression and any loss of interest? |
|---|---|

NO	YES
<b>MAJOR DEPRESSIVE EPISODE, RECURRENT</b>	

\* If patient has Major Depressive Episode, Current, use this information in coding the corresponding questions on page 5 (A6d, A6e).

## MAJOR DEPRESSIVE EPISODE WITH MELANCHOLIC FEATURES (optional)

(➡ MEANS : GO TO THE DIAGNOSTIC BOX, CIRCLE NO, AND MOVE TO THE NEXT MODULE)

IF THE PATIENT CODES POSITIVE FOR A CURRENT MAJOR DEPRESSIVE EPISODE (A3 = YES), EXPLORE THE FOLLOWING:

A5	a	During the most severe period of the current depressive episode, did you lose almost completely your ability to enjoy nearly everything?	NO	YES
	b	During the most severe period of the current depressive episode, did you lose your ability to respond to things that previously gave you pleasure, or cheered you up? IF NO: When something good happens does it fail to make you feel better, even temporarily?	NO	YES
		IS EITHER A5a OR A5b CODED YES?	➡ NO	YES

A6 Over the past two week period, when you felt depressed and uninterested:

a	Did you feel depressed in a way that is different from the kind of feeling you experience when someone close to you dies?	NO	YES
b	Did you feel regularly worse in the morning, almost every day?	NO	YES
c	Did you wake up at least 2 hours before the usual time of awakening and have difficulty getting back to sleep, almost every day?	NO	YES
d	IS A3c CODED YES (PSYCHOMOTOR RETARDATION OR AGITATION)?	NO	YES
e	IS A3a CODED YES FOR ANOREXIA OR WEIGHT LOSS?	NO	YES
f	Did you feel excessive guilt or guilt out of proportion to the reality of the situation?	NO	YES

ARE 3 OR MORE A6 ANSWERS CODED YES?

NO	YES
<i>Major Depressive Episode with Melancholic Features Current</i>	

## E. PANIC DISORDER

(➡ MEANS : CIRCLE NO IN E5, E6 AND E7 AND SKIP TO F1)

E1	<p>a Have you, on more than one occasion, had spells or attacks when you suddenly felt anxious, frightened, uncomfortable or uneasy, even in situations where most people would not feel that way?</p> <p>b Did the spells surge to a peak within 10 minutes of starting?</p>	➡ NO	YES  YES
E2	At any time in the past, did any of those spells or attacks come on unexpectedly or occur in an unpredictable or unprovoked manner?	➡ NO	YES
E3	Have you ever had one such attack followed by a month or more of persistent concern about having another attack, or worries about the consequences of the attack or did you make a significant change in your behavior because of the attacks (e.g., shopping only with a companion, not wanting to leave your house, visiting the emergency room repeatedly, or seeing your doctor more frequently because of the symptoms)?	NO	YES
E4	<p>During the worst spell that you can remember:</p> <p>a Did you have skipping, racing or pounding of your heart?</p> <p>b Did you have sweating or clammy hands?</p> <p>c Were you trembling or shaking?</p> <p>d Did you have shortness of breath or difficulty breathing?</p> <p>e Did you have a choking sensation or a lump in your throat?</p> <p>f Did you have chest pain, pressure or discomfort?</p> <p>g Did you have nausea, stomach problems or sudden diarrhea?</p> <p>h Did you feel dizzy, unsteady, lightheaded or faint?</p> <p>i Did things around you feel strange, unreal, detached or unfamiliar, or did you feel outside of or detached from part or all of your body?</p> <p>j Did you fear that you were losing control or going crazy?</p> <p>k Did you fear that you were dying?</p> <p>l Did you have tingling or numbness in parts of your body?</p> <p>m Did you have hot flushes or chills?</p>	NO	YES
E5	<p>ARE BOTH E3, AND 4 OR MORE E4 ANSWERS, CODED YES?</p> <p>IF YES TO E5, SKIP TO E7.</p>	NO	YES <small>PANIC DISORDER LIFETIME</small>
E6	<p>IF E5 = NO, ARE ANY E4 ANSWERS CODED YES?</p> <p>THEN SKIP TO F1.</p>	NO	YES <small>LIMITED SYMPTOM ATTACKS LIFETIME</small>
E7	In the past month, did you have such attacks repeatedly (2 or more) followed by persistent concern about having another attack?	NO	YES <small>PANIC DISORDER CURRENT</small>

M.I.N.I. 5.0.0 (July 1, 2006)

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## F. AGORAPHOBIA

F1	Do you feel anxious or uneasy in places or situations where you might have a panic attack or the panic-like symptoms we just spoke about, or where help might not be available or escape might be difficult: like being in a crowd, standing in a line (queue), when you are alone away from home or alone at home, or when crossing a bridge, traveling in a bus, train or car?	NO	YES
----	--	----	-----

IF F1 = NO, CIRCLE NO IN F2.

F2	Do you fear these situations so much that you avoid them, or suffer through them, or need a companion to face them?	NO	YES <i>AGORAPHOBIA CURRENT</i>
----	---	----	---------------------------------------

IS F2 (CURRENT AGORAPHOBIA) CODED NO  
and  
IS E7 (CURRENT PANIC DISORDER) CODED YES?

NO	YES
<i>PANIC DISORDER without Agoraphobia CURRENT</i>	

IS F2 (CURRENT AGORAPHOBIA) CODED YES  
and  
IS E7 (CURRENT PANIC DISORDER) CODED YES?

NO	YES
<i>PANIC DISORDER with Agoraphobia CURRENT</i>	

IS F2 (CURRENT AGORAPHOBIA) CODED YES  
and  
IS E5 (PANIC DISORDER LIFETIME) CODED NO?

NO	YES
<i>AGORAPHOBIA, CURRENT without history of Panic Disorder</i>	

## G. SOCIAL PHOBIA (Social Anxiety Disorder)

(➡ MEANS : GO TO THE DIAGNOSTIC BOX, CIRCLE NO AND MOVE TO THE NEXT MODULE)

G1	In the past month, were you fearful or embarrassed being watched, being the focus of attention, or fearful of being humiliated? This includes things like speaking in public, eating in public or with others, writing while someone watches, or being in social situations.	➡ NO	YES
G2	Is this social fear excessive or unreasonable?	➡ NO	YES
G3	Do you fear these social situations so much that you avoid them or suffer through them?	➡ NO	YES
G4	Do these social fears disrupt your normal work or social functioning or cause you significant distress?	<div style="border: 1px solid black; padding: 5px;"> <div style="display: flex; justify-content: space-between;"> <span>NO</span> <span>YES</span> </div> <p style="text-align: center;"><b>SOCIAL PHOBIA</b> (Social Anxiety Disorder) <b>CURRENT</b></p> <p>GENERALIZED <input type="checkbox"/></p> <p>NON-GENERALIZED <input type="checkbox"/></p> </div>	

**SUBTYPES**

Do you fear and avoid 4 or more social situations?

If YES      Generalized social phobia (social anxiety disorder)

If NO      Non-generalized social phobia (social anxiety disorder)

**NOTE TO INTERVIEWER: PLEASE ASSESS WHETHER THE SUBJECT'S FEARS ARE RESTRICTED TO NON-GENERALIZED ("ONLY 1 OR SEVERAL") SOCIAL SITUATIONS OR EXTEND TO GENERALIZED ("MOST") SOCIAL SITUATIONS. "MOST" SOCIAL SITUATIONS IS USUALLY OPERATIONALIZED TO MEAN 4 OR MORE SOCIAL SITUATIONS, ALTHOUGH THE DSM-IV DOES NOT EXPLICITLY STATE THIS.**

**EXAMPLES OF SUCH SOCIAL SITUATIONS TYPICALLY INCLUDE INITIATING OR MAINTAINING A CONVERSATION, PARTICIPATING IN SMALL GROUPS, DATING, SPEAKING TO AUTHORITY FIGURES, ATTENDING PARTIES, PUBLIC SPEAKING, EATING IN FRONT OF OTHERS, URINATING IN A PUBLIC WASHROOM, ETC.**

## H. OBSESSIVE-COMPULSIVE DISORDER

(➡ MEANS: GO TO THE DIAGNOSTIC BOX, CIRCLE NO AND MOVE TO THE NEXT MODULE)

H1	<p>In the past month, have you been bothered by recurrent thoughts, impulses, or images that were unwanted, distasteful, inappropriate, intrusive, or distressing? (For example, the idea that you were dirty, contaminated or had germs, or fear of contaminating others, or fear of harming someone even though you didn't want to, or fearing you would act on some impulse, or fear or superstitions that you would be responsible for things going wrong, or obsessions with sexual thoughts, images or impulses, or hoarding, collecting, or religious obsessions.)</p> <p><small>(DO NOT INCLUDE SIMPLY EXCESSIVE WORRIES ABOUT REAL LIFE PROBLEMS. DO NOT INCLUDE OBSESSIONS DIRECTLY RELATED TO EATING DISORDERS, SEXUAL DEVIATIONS, PATHOLOGICAL GAMBLING, OR ALCOHOL OR DRUG ABUSE BECAUSE THE PATIENT MAY DERIVE PLEASURE FROM THE ACTIVITY AND MAY WANT TO RESIST IT ONLY BECAUSE OF ITS NEGATIVE CONSEQUENCES.)</small></p>	NO    YES ↓ SKIP TO H4	
H2	<p>Did they keep coming back into your mind even when you tried to ignore or get rid of them?</p>	NO    YES ↓ SKIP TO H4	
H3	<p>Do you think that these obsessions are the product of your own mind and that they are not imposed from the outside?</p>	NO    YES <div style="border: 1px solid black; padding: 2px; display: inline-block;">obsessions</div>	
H4	<p>In the past month, did you do something repeatedly without being able to resist doing it, like washing or cleaning excessively, counting or checking things over and over, or repeating, collecting, arranging things, or other superstitious rituals?</p>	NO    YES <div style="border: 1px solid black; padding: 2px; display: inline-block;">compulsions</div>	
	<p>IS H3 OR H4 CODED YES?</p>	➡ NO    YES ➡	
H5	<p>Did you recognize that either these obsessive thoughts or these compulsive behaviors were excessive or unreasonable?</p>	➡ NO    YES ➡	
H6	<p>Did these obsessive thoughts and/or compulsive behaviors significantly interfere with your normal routine, your work or school, your usual social activities, or relationships, or did they take more than one hour a day?</p>	<div style="border: 2px solid black; padding: 10px; display: inline-block;"> <div style="display: flex; justify-content: space-between; width: 100%;"> <span>NO</span> <span>YES</span> </div> <div style="text-align: center; margin-top: 10px;"> <b>O.C.D. CURRENT</b> </div> </div>	



## I. POSTTRAUMATIC STRESS DISORDER (optional)

(➡ MEANS : GO TO THE DIAGNOSTIC BOX, CIRCLE NO, AND MOVE TO THE NEXT MODULE)

I1	Have you ever experienced or witnessed or had to deal with an extremely traumatic event that included actual or threatened death or serious injury to you or someone else?  <small>EXAMPLES OF TRAUMATIC EVENTS INCLUDE: SERIOUS ACCIDENTS, SEXUAL OR PHYSICAL ASSAULT, A TERRORIST ATTACK, BEING HELD HOSTAGE, KIDNAPPING, FIRE, DISCOVERING A BODY, SUDDEN DEATH OF SOMEONE CLOSE TO YOU, WAR, OR NATURAL DISASTER.</small>	➡ NO	YES
I2	Did you respond with intense fear, helplessness or horror?	➡ NO	YES
I3	During the past month, have you re-experienced the event in a distressing way (such as, dreams, intense recollections, flashbacks or physical reactions)?	➡ NO	YES
I4	<b>In the past month:</b> a Have you avoided thinking about or talking about the event ? NO YES b Have you avoided activities, places or people that remind you of the event? NO YES c Have you had trouble recalling some important part of what happened? NO YES d Have you become much less interested in hobbies or social activities? NO YES e Have you felt detached or estranged from others? NO YES f Have you noticed that your feelings are numbed? NO YES g Have you felt that your life will be shortened or that you will die sooner than other people? NO YES ARE 3 OR MORE I4 ANSWERS CODED YES? ➡ NO YES		
I5	<b>In the past month:</b> a Have you had difficulty sleeping? NO YES b Were you especially irritable or did you have outbursts of anger? NO YES c Have you had difficulty concentrating? NO YES d Were you nervous or constantly on your guard? NO YES e Were you easily startled? NO YES ARE 2 OR MORE I5 ANSWERS CODED YES? ➡ NO YES		

I6 During the past month, have these problems significantly interfered with your work or social activities, or caused significant distress?

NO	YES
<b>POSTTRAUMATIC STRESS DISORDER CURRENT</b>	

## O. GENERALIZED ANXIETY DISORDER

(➡ MEANS : GO TO THE DIAGNOSTIC BOX, CIRCLE NO, AND MOVE TO THE NEXT MODULE)

O1	a	Have you worried excessively or been anxious about several things over the past 6 months?	➡ NO	YES				
	b	Are these worries present most days?	➡ NO	YES				
		IS THE PATIENT'S ANXIETY RESTRICTED EXCLUSIVELY TO, OR BETTER EXPLAINED BY, ANY DISORDER PRIOR TO THIS POINT?	➡ NO	YES				
O2		Do you find it difficult to control the worries or do they interfere with your ability to focus on what you are doing?	➡ NO	YES				
O3		FOR THE FOLLOWING, CODE NO IF THE SYMPTOMS ARE CONFINED TO FEATURES OF ANY DISORDER EXPLORED PRIOR TO THIS POINT.						
		When you were anxious over the past 6 months, did you, most of the time:						
	a	Feel restless, keyed up or on edge?	NO	YES				
	b	Feel tense?	NO	YES				
	c	Feel tired, weak or exhausted easily?	NO	YES				
	d	Have difficulty concentrating or find your mind going blank?	NO	YES				
	e	Feel irritable?	NO	YES				
	f	Have difficulty sleeping (difficulty falling asleep, waking up in the middle of the night, early morning awakening or sleeping excessively)?	NO	YES				
		ARE 3 OR MORE O3 ANSWERS CODED YES?	<table border="1"> <tbody> <tr> <td>NO</td> <td>YES</td> </tr> <tr> <td colspan="2"> <b>GENERALIZED ANXIETY DISORDER CURRENT</b> </td> </tr> </tbody> </table>		NO	YES	<b>GENERALIZED ANXIETY DISORDER CURRENT</b>	
NO	YES							
<b>GENERALIZED ANXIETY DISORDER CURRENT</b>								

## Appendix 20: Tests of normality for Phase 3 data using Shapiro-Wilk test

	<b>P value</b>
<b>Age</b>	0.158
<b>Height</b>	0.074
<b>FEV<sub>1</sub></b>	<0.001*
<b>FVC</b>	<0.001*
<b>FEV<sub>1</sub>/FVC</b>	0.168
<b>FEV<sub>1</sub> predicted</b>	0.071
<b>FVC predicted</b>	0.033*
<b>FEV<sub>1</sub> % predicted</b>	0.035*
<b>Pack years</b>	0.157
<b>AIR score</b>	
Initial data	0.003*
Follow-up data	0.001*
<b>CAT score</b>	
Initial data	0.095
Follow-up data	0.867
<b>HADS-A score</b>	
Initial data	0.053
Follow-up data	0.021*
<b>HADS-D score</b>	
Initial data	0.397
Follow-up data	0.089
<b>HADS-T score</b>	
Initial data	0.068
Follow-up data	0.389
<b>MRADL score</b>	
Initial data	0.002*
Follow-up data	<0.001*

\*Statistically significant at <0.05 indicating non-normal distribution for data

## **Appendix 21: Journal article published in International Journal of Geriatric Psychiatry**

Yohannes, A.M., Willgoss, T.G., Baldwin, R.C., Connolly, M.J. (2010) Depression and anxiety in chronic heart failure and chronic obstructive pulmonary disease: prevalence, relevance, clinical implications and management principles. *International Journal of Geriatric Psychiatry*, Vol. 12, no. 12, pp. 1209-1221.

### **Abstract**

#### **Objective**

To review evidence regarding the prevalence, causation, clinical implications, aspects of healthcare utilisation and management of depression and anxiety in chronic heart failure and chronic obstructive pulmonary disease.

#### **Design**

A critical review of the literature (1994–2009).

#### **Findings**

The prevalence of depression and anxiety is high in both chronic obstructive pulmonary disease (8–80% depression; 6–74% anxiety) and chronic heart failure (10–60% depression; 11–45% anxiety). However, methodological weaknesses and the use of a wide range of diagnostic tools make it difficult to reach a consensus on rates of prevalence. Co-morbid depression and anxiety are associated with increased mortality and healthcare utilisation and impact upon functional disability and quality of life. Despite these negative consequences, the identification and management of co-morbid depression and anxiety in these two diseases is inadequate. There is some evidence for the positive role of pulmonary/cardiac rehabilitation and psychotherapy in the management of co-morbid depression and anxiety, however, this is insufficient to guide recommendations.

#### **Conclusions**

The high prevalence and associated increase in morbidity and mortality justifies future research regarding the management of anxiety and depression in both chronic heart failure and chronic obstructive pulmonary disease. Current evidence suggests that multi-faceted interventions such as pulmonary and cardiac rehabilitation may offer the best hope for improving outcomes for depression and anxiety.

## **Appendix 22: Journal article published in Nursing Times**

Willgoss, T.G., Yohannes, A.M., Goldbart, J., Fatoye, F. (2011) COPD and anxiety: its impact on patients' lives. *Nursing Times*, Vol. 107, no. 15-16, pp. 16-19.

### **Abstract**

#### **Background**

Anxiety is a common comorbidity in people with chronic obstructive pulmonary disease (COPD) but its identification and management are often insufficient.

#### **Aim**

To explore the experience of living with and managing comorbid anxiety and COPD from a patient's perspective.

#### **Method**

The study followed a qualitative approach. In-depth interviews were carried out with 14 patients who had COPD.

#### **Results**

Participants believed anxiety had a significant impact on their quality of life. It made them feel isolated and caused them to avoid social occasions and daily activities. Identifying anxiety was a challenge because of the overlap in the symptoms of anxiety and those of COPD, and the side-effects of medication.

#### **Conclusion**

Nurses can play a vital role in screening and managing anxiety, and educating people in strategies to prevent episodes of panic.

**Appendix 23: Abstract presented at the British Thoracic Society Winter Meeting, London, UK. December 2011, and published in Thorax:**

Willgoss, T.G., Yohannes, A.M., Goldbart, J., Fatoye, F. (2011) The development of a novel scale to screen and measure anxiety in patients with chronic obstructive pulmonary disease (COPD). *Thorax*, Vol. 66, Suppl. 4, pp. A44.

**Introduction and objectives**

Comorbid anxiety disorders are common among patients with COPD, affecting up to half of all patients. Comorbid anxiety may be a significant factor in predicting quality of life, yet recognition and management of anxiety among this patient group is poor. Screening and measuring symptoms of anxiety can be challenging due to the overlap of physical symptoms and the lack of a validated disease-specific tool. The aim of this study was to develop a novel non-somatic scale (Anxiety Inventory for Respiratory disease (AIR)) to screen and measure anxiety in patients with COPD.

**Methods**

This study utilised a multi-method approach to scale development incorporating both qualitative and quantitative methods. An item pool was developed using in-depth interviews with COPD patients who exhibited symptoms of anxiety (n=14), and the analysis of existing anxiety scales. Item wording, content and user-friendliness were checked by an expert reference group (ERG) that included clinicians and patients. This item pool was tested on a group of COPD patients (n=82). The Likert-type scale has four consistent responses to statements (Not at all, Occasionally, Frequently, Almost all of the time) that are scored from 0 to 3. Item and factor analysis were carried out to aid in item reduction and to explore the factor structure.

**Results**

Sixteen items were selected for inclusion following development and approval from the ERG. Items were retained based on item-to-total correlation analysis and a-if-item-deleted analysis. One item was discarded as it had a corrected-item-to-total correlation of <0.55. Exploratory principal component factor analysis was performed and three further items were removed due to low communalities (<0.50). Secondary analysis indicated a single factor solution accounting for 66.67% of total variance with a mean communality of 0.67. The 12-item scale had a mean total score of 13.55 (SD=9.41, range=0-36), and a Cronbach's  $\alpha$  of 0.95.

**Conclusions**

The AIR is a short self-report non-somatic anxiety scale with a clear uni-dimensional factor solution and high internal consistency. Additional studies are warranted to further explore the scale's psychometric properties and to establish its ability to screen for clinical anxiety disorders.

## **Appendix 24: Journal article published in Respiratory Care**

Willgoss, T.G., Yohannes, A.M. (2012) Anxiety disorders in patients with chronic obstructive pulmonary disease: a systematic review. *Respiratory Care*, [Epub ahead of print]

### **Abstract**

#### **Background**

There is a growing interest in the role of co-morbid anxiety in patients with chronic obstructive pulmonary disease (COPD). Co-morbid anxiety has major impact on physical functioning, health-related quality of life and healthcare utilisation. However, the prevalence of clinical anxiety, particularly specific anxiety diagnoses, in patients with COPD remains unclear.

#### **Objective**

We performed a systematic review of studies which report the prevalence of clinical anxiety and specific anxiety disorders in patients with COPD.

#### **Method**

We searched for articles in CINAHL, EMBASE, Medline and PsycINFO from 1966 to 31<sup>st</sup> January 2012, with a focus upon studies which utilised a clinical interview for a robust psychiatric diagnosis.

#### **Results**

Of 410 studies identified, ten met the inclusion criteria for review. Studies had small or modest sample sizes (n=20-204) and included mainly male participants (71% male). The prevalence of clinical anxiety ranged from 10-55% amongst inpatients and 13-46% amongst outpatients. Reported prevalence of specific anxiety disorders ranged considerably and included generalised anxiety disorder (6-33%), panic disorder (with and without agoraphobia) (0-41%), specific phobia (10-27%) and social phobia (5-11%). Women were significantly more likely to have a clinical anxiety disorder, particularly specific phobia and panic disorder.

#### **Conclusions**

There is a high prevalence of a clinical anxiety in patients with COPD. Social phobia and specific phobia appear to be particularly prevalent, yet they have received little attention within existing literature. Further research into effective management and screening for clinical anxiety disorders is warranted.

## **Appendix 25: Journal article published in Heart & Lung**

Findings also presented at:

Chartered Society of Physiotherapists Annual Conference, Liverpool, September 2011

IV World Asthma and COPD Forum, Paris, April 2011.

### **Abstract**

Willgoss, T.G., Yohannes, A.M., Goldbart, J., Fatoye, F. (2012) 'Everything was Spiralling out of Control': Experiences of Anxiety in People With Chronic Obstructive Pulmonary Disease. *Heart & Lung*, Vol. 41, no. 6, pp. 562-571.

### **Objective**

This study sought to elicit and describe the first hand experiences of anxiety in community patients with stable chronic obstructive pulmonary disease (COPD).

### **Background**

Anxiety is common among patients with COPD. Clinical anxiety affects up to two thirds of patients leading to reduced quality of life and physical functioning. There has been little research exploring the experiences of anxiety in patients with COPD, particularly in individuals with stable respiratory symptoms.

### **Methods**

We interviewed 14 community patients with stable COPD and self-reported symptoms of anxiety. Data were analysed using thematic network analysis to develop basic, organising and global themes.

### **Results**

Patients reported intense thoughts of fear, hopelessness and confusion that were associated with the anxiety and panic attacks. Self-management was important, particularly self-talk coping strategies.

### **Conclusions**

Unmanaged anxiety appears to be particularly distressing for patients with COPD. Taught self-management strategies can be highly effective in preventing and managing anxiety.